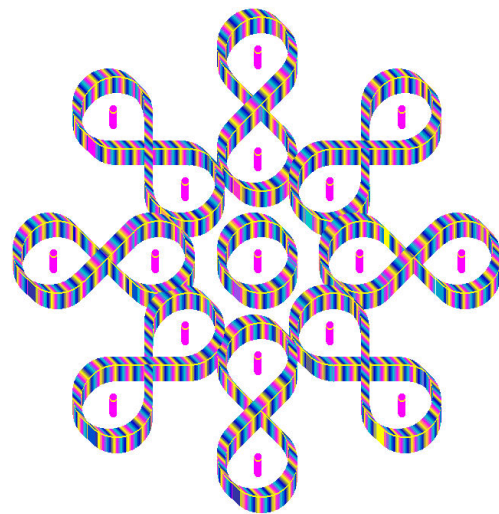
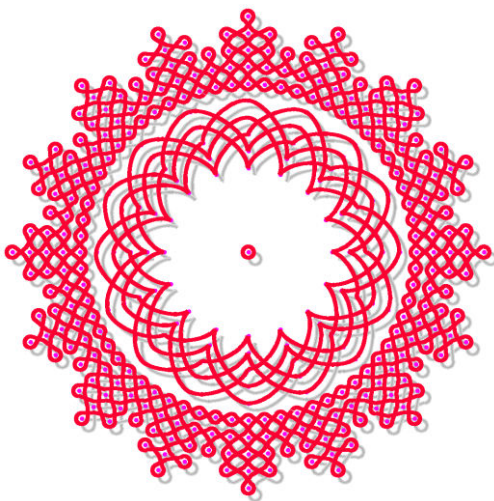


Kolam - A New View

Part 1

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Edition 1.0

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Contents

Preface	4
Acknowledgements	5
Foreword.....	6
1. History of Kolam.....	7
2. Kolam today	20
3. Kolam and myself - 1	34
4. Kolam and myself - 2	50
5. Types of kolams	57
6. Symmetry in kolam.....	62
7. A method of craeting big kolams from smaller parts	65
8. Kolams with lakhs of dots.....	73
9. Suzhi kolam and Line kolam are the same	78
10. Nine kolam learning lessons	79
11. Material used in drawing kolam	80
12. Manai kolam.....	82
13. Katta kolam and achchu kolam	84
14. Snake kolam	88
15. Border kolam.....	91
16. Idaya kamalam.....	93
17. Some well known kolams	97
Bibliography	102

Preface

My sister was in Aranthangi till her marriage. There was about 10 feet between the 'thinnai' and the gravel paved road. There a space of about 10 feet by 10 feet would be cleaned and plastered with cow dung. Usually kolams are drawn there. Next to that is another space of the same size. Normally grass would have grown there. During Margazhi, this grass would be cleared, and more space would be created for drawing kolams.

My mother and my sister used to draw kolams. All our relatives are experts in drawing kolams. In 1979, Mr. Saavi Thambirasu came to Madurai, and taught how to draw thousands of 5 by 5 kolams, using 3 by 2 kolams. From then on my sister became his student. She drew a kolam with more than a lakh of dots, with a single line on a cloth. She has drawn kolams in more than a hundred temples. She had a collection of many hundred kolams in her notebook and sheets.

My passion with kolam made me give projects on kolam drawing in computers, to my students in the college. As an extension of this I myself created an extensive software to draw many types of kolams. More than a decade ago, my sister and myself decided to write a book on kolam. We tentatively selected the topics. I asked my sister to write the matter under these titles. As a result, now I got the material. History of kolam, kolam today, types of kolam, symmetry in kolam, the design of lakh dot kolams, idaya kamalam, aiswarya kolam, puzzles and games based on kolam, kolam software, basic and higher maths and kolam, are some of the topics covered in this book. It contains as much information as we could collect on all these topics.

In many of the current magazines, there are articles on which God will bestow what boons, if we draw which kolam on what date. These are absolutely unsubstantiated statements. Very few books had been written on the topic of kolam and culture. This book is entirely different. It sees kolam in a scientific perspective and gives details.

We want to introduce kolam, which is a more than thousand years old art, to the future generation, in a proper way. We hope that this will create an interest in the youngsters, to take the kolam to the next stage through computers.

Chennai 90
20-08-2022

V. Krishnamoorthy

Acknowledgements

Though my sister Leela has been drawing big kolams from her early age, the learning of systematically drawing big kolams from Mr. Saavi Thamirasu in 1989 made a huge impact in her life. This helped her in going to more than a hundred temples and drawing more than thousand kolams there. Hence our first thanks are due to Kola Pulavar Thambirasu.

There are many steps in drawing kolams in temples. It starts from getting permission from the temple authorities. Then who are all able to come and on what dates is to be ascertained. Their transportation and food arrangements on these days, and arranging for the expenses are some of the managerial activities involved. During 1989 to 2012, till her death, Mrs. Lalitha Sankar did all this, and made drawing kolams in hundred temples possible. I (Leela) consider her as a sister bound by the kolam. Our sincere thanks to her.

From 2012, this work has been continued by her children Mr. Arun kumar, Mrs. Vinodhini, Mr. Aravind kumar, Mrs. Shenba, and her sister Mrs. Sowndari ammal. Our sincere thanks to them also.

From 2017, Mrs. Meena Chidambaram has been coordinating the drawing of kolams in many Chettinadu temples. Our kind thanks to her.

The information that in Sangam literature, the kolam is represented by the word vari has been found by a researcher Ms. Rukmani, was located and brought to our notice, by Dr. Balaraman. Many thanks to him.

We have designed this kolam project with ten parts. One is this book, in both Tamil and English, introducing the ancient art to the new generation in the correct way. A book on systematic method of drawing kolams, a comprehensive computer application to draw all kolams, a software to show different kolams on different days, puzzles based on kolam, games based on kolam, exercises in drawing kolams, a 3 in 1 puzzle with about 80 chips, both as software and hardware, Short videos on kolam, and a coloring book based on kolam. We decided that these software and soft copies of books should be available to the public, especially students freely, so that it will have the maximum reach.

To complete the project and maintain it, many large hearted sponsors have helped. Our sincere thanks are due to all of them.

Foreword

ஒளவை அருள்
இயக்குநர்



தமிழ் வளர்ச்சித் துறை.
தமிழ் வளர்ச்சி வளாகம்.
தமிழ்ச் சாலை, எழும்பூர்.
சென்னை - 600 008.

நாள்: 13.09.2023

அழிபாத கோலம்

முனைவர் வெ. கிருஷ்ணமூர்த்தியும், மகளிர் திலகமாக மிளிரும் லீலா வெங்கட்ராமனும் இணைந்து யாத்த இப்பனுவல் பயணுறு வண்ண விருந்தாக அமைந்துள்ளது. பக்கந்தோறும் கோலத்தைப் பதிவிட்டு எளியநடையில் விளக்கங்கள் வரைந்துள்ள சிறப்பினைப் பாராட்டி மகிழ்கிறேன். கோலத்தின் வரலாறு, இன்றைய கோல வகைகள், சமச்சீர்த்தன்மை, பெரிய அளவில் கோலங்கள் வரைவதற்கான நேர்த்திமுறைமை, மாதிரிக் கோலப் புத்தகம், கோல மென்பொருள், கோலப் புதிர்கள், கோலக் கணிதங்கள் எனப் பலவற்றின் சுவையான தகவல்கள் இந்நூலில் விரவியுள்ளன.

அண்ணாநகர் தாரகை இல்லத்தின் வாயிற்படியில் நாள்தோறும் கோலம் வரையவேண்டும் என்பதில் அதிக ஆர்வம் காட்டியவர்கள் என் அம்மா. பல நேரங்களில் அம்முயற்சி நடைபெறாமலேயே நின்றுவிடும். சில ஆண்டுகளுக்கு முன்பு என் நெருங்கிய நண்பர் வாயிலாக வண்ணக் கோலங்களை வரைவதில் வல்லுனரான திருமதி கோகிலா எங்கள் அண்ணாநகர் தாரகை இல்ல முகப்பில் தெருவில் நடப்போர் அனைவரின் பார்வையையும் திருப்பும்படி மாபெரும் வண்ணக் கோலத்தினை வரைந்துகாட்டி என் அம்மாவின் நீண்ட நாள் விழைவினை நிறைவேற்றினார்.

கழிக்கோலம், கோட்டுக்கோலம், கட்டக்கோலம், கரைக்கோலம், அச்சுக்கோலம், எனக் கோலங்களின் வகைப்பாடுகளைக் கண்டு கண்கள் விரிகின்றன. கோலத்திற்கான அடிப்படைக் கணிதமும் விளக்கப்பட்டுள்ளது. கணினியின் தொழில்நுட்ப உதவியால் எல்லையற்ற கற்பனைத் திறனைக் கொண்டு விரும்பும் வகையிலெல்லாம் புள்ளிகளையும் கோடுகளையும் இட்டுக் கோலங்கள் வரைவதற்குப் பேராசிரியர் கிருஷ்ணமூர்த்தி மென்பொருள் உருவாக்கியிருப்பது எல்லையில்லா மகிழ்ச்சியளிக்கிறது.

கோலம் குறித்த வழிகாட்டும் நூலினை எண்ணத்தால், வண்ணத்தால் குழைத்துள்ள இணையற்ற இரு ஆசிரியர்களை வாழ்த்தி மகிழ்கிறேன். கோலம்செய் பெருமக்களையும், செம்மாந்த நூலினையும் பார்க்க / படிக்க வாய்ப்பு நல்கிய மாநிலக் கல்லூரியின் தனிப்பெரும் முதல்வர் பேராசிரியர் முனைவர் இராமன் அவர்களுக்கும் நன்றி மலர்களை அணிவித்து மகிழ்கிறேன்.


(ந. அருள்)

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1. History of Kolam

Pre historic people used to put colored lines on their bodies, to decorate themselves. Even today we can see the saivaites putting 3 horizontal lines of white ash, called vibhuthi, in their forehead.

Vaishnavies put thin vertical lines. We can see this habit among the aborigines all over the world.

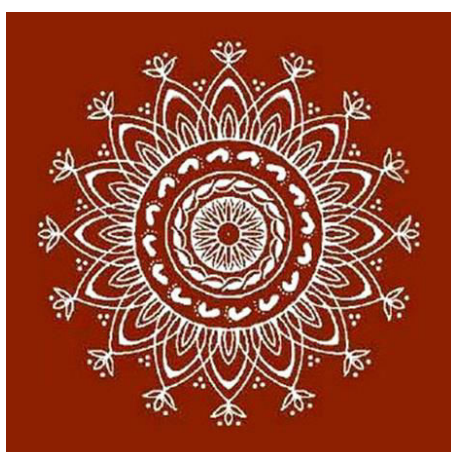


We find two images in the copper plates of Harappa, which can be termed as Kolam. The first one is supposed to indicate the endless cycle of life and birth,



This 3D looking drawing is supposed to represent karma in Buddhism.

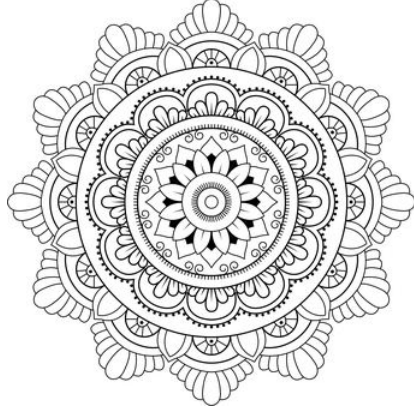
In Sangam period drawing on the body was called 'writing thoyvil'. When drawing lines on the floor in olden days, they started doing it in a beautiful way. We can say that this lead to the current versions of suzhi and line kolam from India, especially from Tamilnadu. Since you don't see them in North India today, and since there are references to kolam from sangam literature onwards, we can infer this.



Alpana



Arpan



Mandala



Rangoli

Arts like kolam has sprung in many parts of India. They are called with different names in different parts. It is called Alpana in Bengal, Arpan in bihar, mandala, and rangoli in north India. These are drawn without putting dots. Kolam is called muggu in Andhra and Telengana, and, as rangavalli in Karnataka. Now we will see the references to kolam in Tamil literature.

There are references regarding thoyyil in sangam literature. The word kolam appears in many places in sangam literature. But they do not represent the kolam drawn in front of the house. They mean things like beauty and form. Here we will see two examples for kolam in Natrinai of sangam literature. There are references regarding thoyyil in sangam literature. The word kolam appears in many places in sangam literature. But they do not represent the kolam drawn in front of the house. They mean things like beauty and form. Here we will see two examples for kolam in Natrinai of sangam literature. 'வரி புனை சிற்றில் பரி சிறந்து ஓடி' (123ஆம் பாடல், வரி 8).

For this, in the first commentary which came in print, in 1915, Pinnaththur A. Narayanasamy Iyer(1862-1914), explains it as,

'கோல மிடுதலையுற்ற சிற்றில் புனைந்து சிறப்ப விரைந்தோடி விளையாடி'

For 'ஓங்கு மணல் வரியார் சிறுமனை சிதைஇ வந்து' (378ஆம் பாடல் வரிகள் 8,9), he explains it as, 'உயர்ந்த மணற்பரப்பிலே புனைந்து கோலமிட்ட சிறிய மணற்சிற்றிலைச் சிதைத்து'. These have been quoted by Prof. Rukmani in the article published on 16th January 2016, in siragu.com/தமிழர் பண்பாட்டில் கோலங்/.

In 1989, Dr Vu Ve Sa library in Besant Nagar, Chennai, published Natrinai with commentary, based on the notings of Dr Vu Ve Sa. Vidwan H. Vengadaraman is the editor for this. In this book, in the commentary, for the two above mentioned places, the following is given. 'கோலம் புனைந்த சிறிய மணையில்', 'புனைந்து கோலம் இட்ட சிறிய மணற் சிற்றிலை சிதைத்து'.

Here the word வரி is interpreted as கோலம்.

Lines 2 and 3 of poem 351 of Kurunthokai talks about the lines on the sand, made by the crabs.

'அனைவா மூலவன் கூருகிர் வரித்த

ஈர்மணன் மலிர்நெறி சிதைய'. For the word வரி Vu Ve Sa gives the meaning as 'வரித்தல் - கோலஞ்செய்தல்; இங்கே கோடு கோடாகக் கீறுதலென்று கொள்க'.

From these it can be inferred that in sangam period, the word வரி represented the kolam drawn in front of the house.

The sands of the beach has lines made by the waves. To represent it, the Neithal Thinaï poems uses the words வரிமணல் in many places. Here வரி means line. We can infer that like this in the sangam period, the lines of kolam also have been represented by the word வரி.

The children imitate what adults do. They see the adults drawing kolam in front of the houses, and they do draw kolam in front of the tiny houses they build. These show that kolam was in vogue in the saangam period itself.

The references is in Periaazhvaar's Thirumozhi, as

'வெண்மணற் கொண்டு

சங்கு சக்கரம் தண்டுவாள்

வில்லு மல்ல திழைக்க லுறாள்' - 7ஆம் திருமொழி 3ஆம் பத்து, 3ஆம் பாடல்

and, in Aandaal's Naachchiyaar Thirumozhi, as

'வெள்ளை நுண்மணல் கொண்டு சிற்றில் விசித்திருப்ப வீதிவாய்த் தெள்ளி நாங்கள் இழைத்த கோலம் அழித்தியாயினும் உந்தன் மேல் உருகும் நெஞ்சம்' நாமமாயிரம் 5 : 1 -1 3.

These are supposed to have been written in the seventh or eighth century B.C.

'திகழ்செய் கோலத்திருமணையில்' 3.22 : 203 comes in Perungathai.

In Kamba Raamaayanam we have references to kolam. This shows that around twelfth century B.C. drawing kolams was prevalent in Tamilnadu.

"நீர்க்கோல வாழ்வை நச்சி' கும்பகர்ணன் வதைப்படலம் 154 : 1

'நீர்மேலைக் கோலமெனும் நலைமைத்தன்றே' - இராவண வதைப் படலம் 204 : 4

'பங்கய மலரடி பஞ்சில் குறித்த கோலங்கள்' - ஊர்தேடு படலம் 127

In seventeenth century Kumaraguruparar sings as, 'தரை மெழுகிக் கோலமிடு' (25 : 1) in Meenatchi ammai kuram.

In Thirukkutraala thala puraanam, it is written as, 'உம்பர் மேல் உதிரக் கோலமிட்டென' தக்கன் வேள்வி அழித்த சருக்கம் - 28 : 1-3.

Maha Kavi Bharathi sings as 'கோலமிட்டு விளக்கினை ஏற்றி' - அந்திப்பொழுது - காதலி பாட்டு 5 : 1.

Bharathi daasan sings as 'அரிசிமாக் கோலம் அமைத்தனள்' குடும்ப விளக்கு - முதல் பகுதி 27-28.

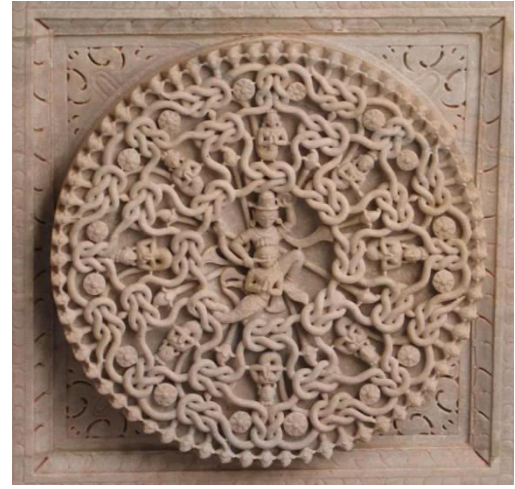
Kavimani Desika vinayakam pillai sings 'அஞ்ச வயதுமகள் கோலமிட்டால் - அதை

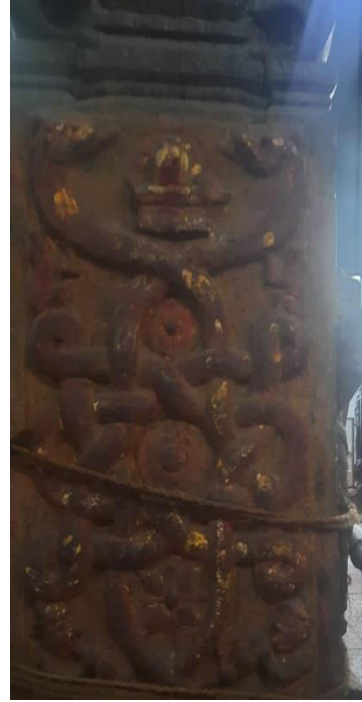
அழகில்லை என்றழிக்கும் தாயாருமுண்டோ?' மலரும் மாலையும் 894 :1-2

'முற்றத்துக் கோலத்தை முன்னழிக்கப் பிள்ளையில்லை' sings a folk song.

In the current century there are many places in novel, short stories, hikoos etc., where kolam gets mentioned. We will not be seeing them. This shows the prevalence of kolam in the last few centuries.

Kolam in temple sculptures





We can see a kolam made up of a single line in a roof of the temple of Chenna Kesava, in Somanathapura of Karnataka. (Thanks to: Ms Sarah Welch - Own work, CC BY-SA 4.0, <https://commons.wikimedia.org/w/index.php?curid=62668829>). This has a 3D look, with lines going one over the other. Some parts of the kolam have broken down. This single line kolam is supposed to represent the state where there is no starting or ending. This temple is opened in the year AD 1258. It is a temple with beautiful carvings.

The next image shows a snake kolam(Thanks to Sakthi). This is a very beautiful carving in a roof of the Jain temple in Ranakpur of Rajasthan. This is supposed to represent karma. This temple was built in the fifteenth century AD.

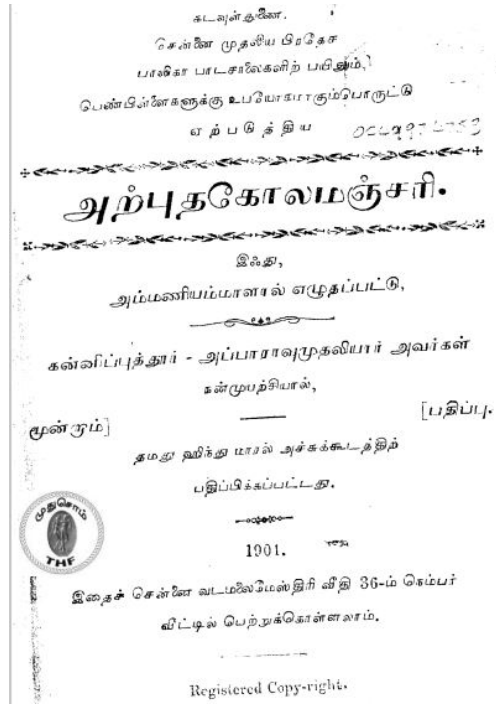
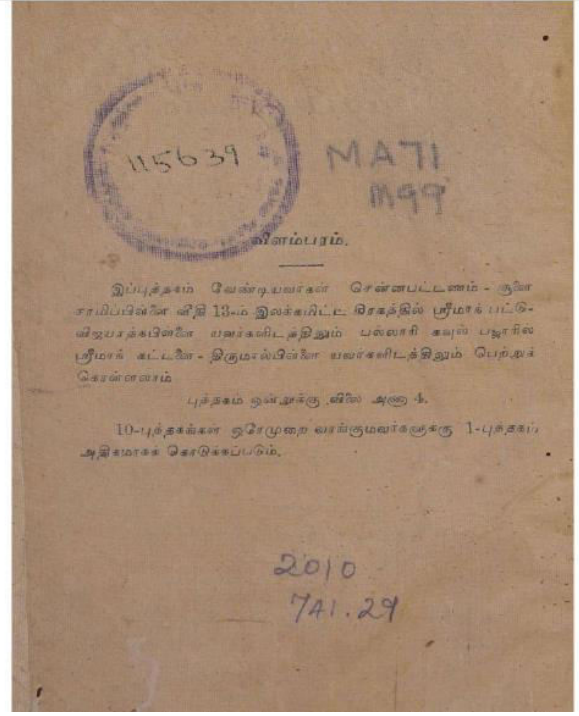
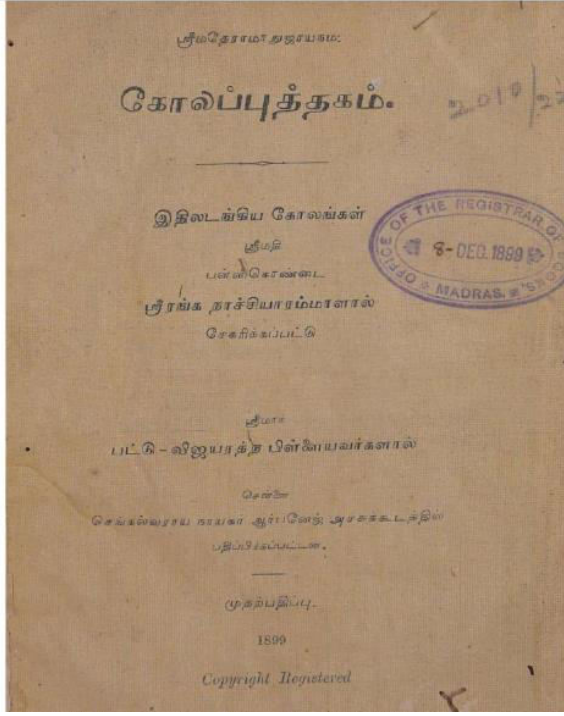
In a pillar in the amman sannithi in the Thiruvengadamudaiyan kovil of Ariyakkudi, we can see a sculpture of a pinnal kolam. This temple is supposed to be about 500 years old. Some of the lines are straight, and some are curved. In the upper portion there seems to be an extra line, which is not required. This kolam may be an attempt to sculpt an endless kolam. This was seen by me(Leela) when we went there recently to draw kolams.

In the next image we can see a snake kolam in the outer pathway of swamy sannidhi of Madurai Meenakshi Amman temple.

Benefits of drawing kolams

When you draw the kolam on the floor, you have to bend and do it. This is an exercise to the body.

For drawing big kolams you need extreme concentration. This gives an exercise in concentrating.



When we searched for ' கோலப்புத்தகம் ' in

https://rmrl.in/rmrlbooks/query/search_comprehensive.html of Roja Muthiah Library, we got,

திருவேங்கடம் பிள்ளை, பெ. ப | Tiruvēṅkaṭam Piḷḷai, Pe. Pa

அட்டமங்கலத்துள் ஒன்றாகிய கோலப்புத்தகம் | Aṭṭamaṅkalattuḷ onṛākiya Kōlapputtakam

ஆதிகலாநிதி அச்சுக்கூடம், Ātikalāniti Accukkūṭam, 1884

Shelf mark. 016912

மஹாலட்சுமி கோலப்புத்தகம் | *Mahālaṭcumi kōlapputtakam*

பூமகள்விலாச அச்சுக்கூடம், Pūmakalvilāca Accukkūṭam, 1928

Shelf mark. 088755

When searched for 'கோலப்புத்தகம்' in <https://archive.org/search.php> we got two books.

First book is published in 1889 under the title 'கோலப்புத்தகம்'. It is mentioned that this book is available in Tamil Virtual Academy, Chennai. The kolams were collected by Sriranga Naachchiyaarammaal. Its price was 4 anaas. It was quite an amount in those days. It is somewhat surprising that there were many who could buy this book.

The second one was published in 1895 in Pondicherry. The title was 'கோலப்புத்தகம்'. It was written by Subbammaal.

You can see them as eBooks. Their links are also given. Just clicking on them will take you to these books.

From the available books, we see that kolam books have been continuously published in years 1884, 1889, 1895, 1901, 1928, 1961.

The 'Arputha kola manjari' published in 1901 says it is third edition. This shows the patronage and sales of kolam books even hundred years before! This book was written by Ammani Ammaal.



The kolam book we have was published in 1961. It costs 6 annaas. All the kolams in this book has names both in Tamil and Telugu. They are given here to show the variety.

Page 2 - 1. Cashew bunch 2. Rangoon steamer 3. Lotus leaf. 4. Bitter gourd. 5. Baby cradle 6. Krishna's anklet.

Page 3 - 7. Flower plane 8. Bajee bandhu 9. Wedding platform 10. Cradle 11. Yaaga saalai

Page 4 - 12. Homam Platform 13. Homam kundam 14. Platform 15. Theppakkulam

Page 5 - 16. Scissors 17. Spider 18. Pearl pandal

Page 6 - 19. Cradle 20. Kala bundle 21. Dheepaaraathanai plate 22. Theppakkulam

Page 7 - 23. Bramman knot 24. Thaambaalam plate 25. Koojaa (water bottle)

Page 8 - 26. Parrot cage 27. Flower plane 28. Bramman knot 29. Bouquet 30. Sunflower

Page 9 - 31. Wedding Platform 32. Wedding Platform 33. Avarai beans bunch 34. Bramman knot 35. Bramman knot

Page 10 - 36. Sacred lamp 37. Pearl box 38. Bramman knot 39. Bhaji bhandhu 40. Theppakkulam

Pge 11 - 41. Thaamarai kamalam 42. Pearl box 43. Bitter gourd 44. Mountain 45. Thaamarai kamalam

Page 12 - 46. Garudan 47. Pineapple flower 48. Pineapple fruit 49. Lasthar plate 50. Nose ring

Page 13 - 51. Toffee packet 52. Rathna bedspread 53. Wedding platform

Page 14 - 54. Fish 55. Elephant 56. Wedding Entrance 57. Mandapam

Page 15 - 58. Bouquet 59. Mirror 60. Thaambaalam plate

Page 16 - 61. Thulsi pot 62. Krishnan Cradle 63. Powthram 64. Baby cradle

Page 17 - 65. Swing board 66. Flower plant 67. Kala bunch 68. Elephant footprint

Page 18 - 69. Dove cage 70. Tortoise shell 71. Krishna anklet 72. Banthi bouquet

Page 19 - 73. Rangoon fan 74. Thaaya kattam 75. Panneer pot 76. Bramha knot 77. Swing board

Page 20 - 78. Toffee pack 79. Flower plane 80. Powthram 81. Powthram 82. Jamedhar Pearl palanquin

Page 21 - 83. Wedding platform 84. Four sided Snake board 85. Merry go round 86. Pomegranate bunch

Page 22 - 87. Powthram 88. Single snake Bhandanam 89. Beans Pandal 90. Sofa

Page 23 - 91. Sandal bowl 92. ??? Fruit

Page 24 - 93. Parrot 94. Flower pot

Aandaal and kolam

In her book Vijaya quotes two English translations of Aandaal's Naachchiyaar thirumozhi.

1. 'தையொரு திங்களும் தரை விளக்கித் தண் மண்டலம் இட்டு மாசி முன்னாள்

ஐய நுண் மணல் கொண்டு தெரு அணிந்து அழகினுக்கலங்கரித்தனங்கதேவா' is translated as,

'Through the month of Tai

I swept the ground before my house,

made *sacred mandalas* of fine sand.

The month of Maci has begun,

I have adorned the street,

offered worship to your brother and you'

- Vidya Dehija 1990, 'Andal and Her Path of Love: Poems of a Woman Saint from South India', Albany: State University of New York Press.

'In the month of Tai

I swept the ground and drew *sacred mandalas*.

In the month of Maci

I decorated the street with fine sand,

After all this adornment for beauty's sake, O Ananga'

- Archana Venkatesan 2010, 'The Sacred Garland: Andal's Thiruppavai and Nachiar Thirumoli, Translation with Introduction and Commentary' , New York: Oxford University Press.

2. 'வெள்ளை நுண் மணல் கொண்டு தெரு அணிந்து' is translated as,

'With fine white sand

I decked the street' - Vidya Dehejia 1990

'I decorated the street with fine sand' - Archana Venkatesan 2010.

3. 'வெள்ளை நுண் மணல் கொண்டு சிற்றில் விசித்திரப்பட வீதி வாய்த்

தெள்ளி நாங்கள் இழைத்த கோலம் அழித்தியாகிலும்' is translated as,

'Along the street we drew

auspicious diagrams' - Vidya Dehejia 1990

' We built these lovely sandcastles with fine white sand,

to decorate every threshold' - Archana Venkatesan 2010.

The italics are ours. There seems to be some problems with these translations. Both translate mandalm as sacred mandalas. The word sacred has been deliberately added to the Sanscrit word mandala. The author Vijaya suspects that it may indicate the forcing of the north Indian culture. This view seems to be reasonable. The two meanings given in the Madras University lexicon has to be considered here. One is "To prepare a place by cleansing it with water, as for dining or worship; உண்ணுகை பூசை முதலியவற்றிற்காக நீர் தெளித்துத் தடவி இடம் பண்ணுதல். 'நீரைத் தெளித்துத் தடவி மண்டலமிட்டு' (சிலப். 16, 41, உரை)." The second one is, "See மண்டலம் போடு". One meaning given here is "To make ornamental, astrological or mystic diagrams, commonly circular; சக்கரம் முதலியன வரைதல்". In these the first one seems to be apt. Here is why. Here we have 'தண் மண்டலம் இட்டு'. Though தண் has meanings குளிர்ச்சி, நீர், and அருள், mostly it is used with the meaning 'cool'. For example தண்ணீர். Preparing the ground by sprinkling cool water, or, Preparing the cool ground by sprinkling water. Connecting the word cool with drawing circles seem to be not appropriate. Also, the words which say that the floor is cleaned indicates the importance given to cleaning the floor. From this and from the next lines which say that the next month we decorated the street with nice sand, we can infer that in the month of Thai also the street was cleaned.

Some of the mandalas are called yantras. In the translation and comments on Soundarya lahari, published in 1937, the place where the 103 yantras have to be put. Most of them are gold plates. In these circumstances, we can safely infer that **sacred** mandalas would not have been put on the

streets. So we can think that there is enough evidence to show that the translation as **sacred** mandalas is wrong.

In many Pillaiththamizh poems, it is mentioned that for the male child, for the seventeenth /eighteenth months, it is natural to do சிற்றில் சிதைத்தல். For the female child it is சிற்றில் இழைத்தல். The word சிதை is usually used with the word சிற்றில். Aandal uses the phrase 'சிற்றில் வந்து சிதையேலே' 4 times; 'சிற்றில் நீ சிதையேல்' once. Uses the phrase சிற்றில் ஈடழித்து 'once. When she talks about kolam, she uses the word ' அழித்தியாகிலும் '. Also, when she talks about சிற்றில், she uses the words வண்டல் நுண்மணல் and மணலும். *But only when she talks about kolam she uses the word வெள்ளை நுண்மணல். That is white nice sand. Only to draw kolam you need white sand. To build a toy house, any sand is OK. This usage of white sand and the word அழித்து, shows that in the lines 'வெள்ளை நுண் மணல் கொண்டு சிற்றில் விசித்திரப்பட வீதி வாய்த்*

தெள்ளி நாங்கள் இழைத்த கோலம் அழித்தியாகிலும் ', the word கோலம் definitely means the kolam drawn in front of the house and not otherwise.

Both of the translators quoted by Dr Vijaya, have translated this part as 'Along the street we drew auspicious diagrams' and 'We built these lovely sandcastles with fine white sand, to decorate every threshold'. For those who translate as sacred mandala, it does not seem appropriate to use the direct translation as kolam. It is suspected that in order to show the supremacy of north Indian culture, the direct translation has been skipped deliberately. It is to be noted that all those who do not agree that the previous occurrences of the word kolam do not mean the current meaning, agree that Aandals usage is the first instance with the current meaning of the kolam drawn in the front of the house.

Some say that there are references of kolam in old north Indian literature, and kolam originated there. We have shown here that from sangam period Tamilnadu has the culture of drawing kolam. Also shown that a few hundred years ago kolam can be found in the temple sculpture of Tamilnadu. Moreover there are continuous references to kolam in Tamil literature. Before one hundred and forty years ago we have printed books of kolam. This shows the prevalence of good knowledge of kolam among the women folk of Tamilnadu before hundred years. They had the curiosity to know more on kolam. This has resulted in the publication and sales of many kolam books, some in multiple editions. Today kolam is can be seen in the front of every Hindu home. It can be seen in advertisements, marketing, and in hundreds of websites. Classes have been conducted to draw kolam systematically. The mathematical aspects of kolam is being studied. This shows that the tradition of kolam has been there in TamilNadu for about two thousand years **continuously**. Here by kolam we mean the suzhi and line kolams, and not rangoli. These are not seen in north India currently. Only rangoli seems to have

flourished there. So it is wrong to say that kolam originated in north India. Kolam has its roots in Tamilnadu and still flourishes here.

2. Kolam today

Today kolam has become an integral part of every Hindu family, having been drawn everyday in front of their houses. Rice flour, kolam powder, color powder, roller, plastic sticker are the different things used today in drawing kolam. Daily, weekly and monthly newspapers and magazines definitely bring out special issues on kolam during Marhazhi month. In magazines, and in many cities there are kolam contests every year. Dinamalar conducts kolam contests in the streets of many towns. Puducherry and many other towns organize kolam contests every year.

Often there are articles on kolam in all the Tamil magazines. There are contests on kolam. The information given below is taken from the newspaper clippings of my sister. As samples, we give some of them here.

On 06-12-2020 there was an advertisement regarding the results of a lamps kolam contest. It showed some of the winning entries. It says there are more than 900 gold coins to be won!

J2

THE HINDU
SUNDAY, DECEMBER 6, 2020

KALEESUWARI
REFINERY PRIVATE LIMITED

RAINING GOLD
WITH
DHEEPAKOLAM
CONTEST

They created a DheepaKolam. They won Gold.

Congratulations to all Winners.
Over 900+ Gold Coins are waiting for you.

THE PROUD GOLD COIN WINNERS

V. Mayilvel Chennai	Nagaraj Chennai	Nithya aravind Tiruv	Meera Chennai	E. Muthulakshmi Thotakudi	Kavya Shankar Vellore	V. Nivetha Coimbatore	S. Malina Chennai	B. Saranya Tirup	S. Jayalakshmi Coimbatore
Aarthi Chennai	D. Sangeetha Chennai	C. Rajeswari Chennai	C. Shanthi Chandrasekar Tirunelveli	E. Saikala Coimbatore	G. Mallika Chennai	P. Vennila Salem	R.K. Reshma Chennai	R. Gomathi Dharmapuri	Moova Tirupattur

In January 2021, DinaMalar conducted a kolam contest in the apartments of Madurai. It says the prize is worth 5 lakhs of rupees. In December 2022, The Hindu paper conducted a lamp kolam contest. There are some records created on drawing kolams. Some of them are given below. On 30-04-2005, on behalf of Ambattur Anandam Old age home, around 60 ladies, including some elderly ladies, drew

kolams in an area of 865 square meters, that is 9,320 square feet. They had drawn pulli kolams and rangoli. This news came in the Madurai Dinamalar edition of 10-07-2005.

On 28-01-2007, on the road in the Marina beach, for 2.3 kilo meters and a width of 4 feet, kolams were drawn. This was sponsored by Dinamalar daily and Hamam soap. This was recorded in the Limca book of records. In 2002, in Nagpur, they had drawn rangoli for 1.5 kilo meters with a width of 4 feet. This was available in Limca book of records. To surpass this record they had arranged the kolams at Marina. A Dinamalar article on 29-01-2007 says this. It adds that thousands of people participated in this.

This news came in the Hindu Tamil Thisai of 31-01-2020. In order to popularize Tata Chakra Gold tea, a program was organized in Coimbatore. 500 different kolams were drawn in this program. This was done to have a place in the Asia book of records. Ten kolams which had won prizes in an earlier kolam competition were included in these.

Mr. Savi Thambirasu has conducted kolam classes in many towns.

Leela has crated the first kolam with more than a lakh of dots on white cloth. She was part of the groups which have put lakh dot kolams in Meenakshi amman temple. The kolam in a cloth of size 12 by 12 feet was exhibited first in the 'Kolam Rangoli Exhibition' conducted in Chennai, during November 18 th to 30th of 1981.

TATA TEA
Chakra Gold
En Vazhi Tamizh Vazhi

TATA TEA
Chakra Gold
Premium Tea

TATA Tea Chakra Gold congratulates the winners of En Vazhi Tamizh Vazhi Kolam Contest

These 10 winning kolams will be part of our Asia Book of Records attempt for 'Most Number Of Unique Kolams In A Single Place', today.

 Kavlyasree	 Chinnakatesh	 Pushpalatha	 V. Chandra	 A. Prabha
 Sri Thangamalai Murugan	 Sanya	 Victor Thomas	 Padmashree Raghothaman	 Sundara Saraswathi

தமிழர்களுக்கான, இ. முறைப்படியான தே.

Venue: Avinashilingam Deemed University for Women, Coimbatore

ASIA BOOK OF RECORDS

2 THE HINDU - FRIDAY, SEPTEMBER 20, 2013

RmKV Aishwarya Kolangal Sarees.
Silks for an auspicious Diwali.

This Diwali, RmKV breathes new life into an age-old tradition, with the exclusive range of Aishwarya Kolangal Silk Sarees. Depicted in exquisite detail on the pallu are traditional kolam designs. The borders too are adorned with intricate kolam motifs, all designed and woven exclusively by the RmKV design studio.

Available in 5 colours

Mana Kolam

Kubera Kolam

Aishwarya Kolam

TRADITION





Tata tea manufacturers use kolam contest to market one of their products. Tanishq jewel manufacturers use kolam in their marketing. RMKV sari producers and sellers have created saris with big kolam designs, and give big advertisements. Recently in July 2022, there is a news in the net, that Mrs. Dheepika of Srirangam earns good amount by painting kolams on pallaanguzhi, voojnal etc. Kolam forms the background in many invitations. Kolams decorate things like curtains, table cloths, pottery, thamboolam bags, plates, and oil cans.

கணிதக் கல்வி மையம்
ஒளவை கலைக் கழகம்
B, கோழ செட்டி, 4-வது தெரு, இராமநாதர்,
சென்னை-600 013.

துவக்க விழா அழைப்பிதழ்

மூன்று நாள்
மாநிலக் கருத்தரங்கும்
பணிமனைவும்

94 பிப்ரவரி
17, 18, 19 தேதிகள்
(வியாழன், வெள்ளி, சனி)

பொருள் :
கோலும் பன்முகக் கணக்கும்

☎ 55 56 08


இங்ஙனம்,

<p>அரு. சங்கரலிங்கம் தலைவர், ஒளவை கலைக் கழகம்</p> <p>N. சுப்பிரமணியன் தலைவர், ஸ்ரீ ஸ்ரீ நாதன் சிந்தியா சேவா சமிதி</p>	<p>A.T.B. போஸ் செயலர், ஒளவை கலைக் கழகம்</p> <p>M. K. முத்தீவராவன் செயலர், ஸ்ரீ ஸ்ரீ நாதன் சிந்தியா சேவா சமிதி</p>	<p>Dr. இராணி சீரோமணி இயக்குநர், கருத்தரங்கு, பணிமனை</p> <p>P. K. முத்தீவராவன் தலைவர், கணிதக் கல்விமையம்</p>
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(தமிழ்நாடு)

'RANGOLI AND MATHEMATICS'
P.K. SRINIVASAN
Resident Curator, Ramanujan Museum

The art of Rangoli is a living tradition of our country evolved over centuries by the collective genius of our people. Its aesthetic appeal transcends caste and community set ups, linguistic regions and even religious denominations. Without taking an etymological escapade into the origins of Rangoli or Kalam with its spiritual undertones and cultural overtones, it would be enough if it is understood that people in the North colour the enclosed spaces in designs with matching hues and call them *Rangoli* whereas people in the South leave the designs as they are without colouring and call them *Kolam* (Fig. 1)



Kolam



Rangoli

Fig. 1

It is a display of manual dexterity guided by aesthetic imagination of a very high order. It is a tribute to the creativity in man, woman in particular though it is not given its due place in school curriculum till today. Its blend of discrete and continuous, discloses its mathematical base which enhances one's appreciation of beauty in Kolams.

The art is seen as floor display of drawing with fingers using rice flour or white stone powder at the entrance to the main gate of many a residential building. It is almost an every day practice with religious fervour generally by women folk in the early hours of morning and some times in the evenings as well. The display reaches its crescendo in the month of Margazhi (Dec-Jan) every year. It is made up of joins of points, twisting or turning curves round points or a blend of all across a frame work of dot patterns. To enhance the cultural appeal, sometimes conventionalised or abstract forms of deities, birds, animals, snakes, flowers etc. are incorporated in Kolams. The art forms are of remarkable diversity from the simplest to the most intricate, with no limit on floor space. The



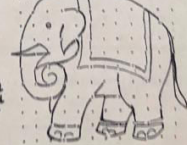




Fig. 2

symmetries and regularities that emerge provide the kolam artist with supreme satisfaction and sense of triumph. It requires a trained eye to detect where to begin a kolam, whether it is composed of a single strand or not and what path or paths to follow in fitting it.

It is amazing how kolam designs are stored in the memory of a kolam artist through remembrance of dot patterns with their *generating line up-dots (GLD)* and distribution of dots above and below the GLD. The distribution pattern of dots once made on a plane surface gives direction of movement in drawing a Kolam. The same distribution often suggests more than one kolam belonging to J type (joining type), T type (twisting type), t type (turning type) or a blend of any two of the types or of all types.

1

Mr. P. K. Srinivasan arranged a seminar on 'Kolam and School Mathematics' during February 17, 18, 19, of 1994, on behalf of Chennai Avvai Kalai Kazhakam. He collected the information discussed in that seminar in a booklet. It was created using stencil sheets. Does not seem to have been published as a printed book.



Kolam was in the US media when a large kolam was arranged in front of the Capitol building in Washington, DC, USA. This was to mark the 100th day in office of Ms. Kamal Harris, as Vice President of USA, on 24th April 2021. This was a cooperative effort of hundreds of people, designed and coordinated by Ms. Shanthi Chandrasekar. This kolam was made up of about 1950 cardboard pieces. Each piece had a small part around one dot of the kolam. Each had its own colorful setting. Each piece was about one and a half feet by one and one and a half feet in size.



In The Hindu newspaper dated 20-08-2023, there was a photo of team playing music in Chennai. The background banner of the stage shows a big kolam in the middle. There is a border kolam at the bottom also. Our kolam software will make the dots and lines of such kolams on the banner more beautiful.



A video of a Chinese preparing a dosa like food item is being shared in the net very much. He draws kolam like lines. The accompanying lines say 'Tamilan drew kolam. He did dosa. Chinese is doing both together'.

Another picture trending in the net is the kolam like picture having the words 'tamilnadu'. It does not have symmetrical dots. The lines go around some dots. This raises the question of what is a kolam. Since many changes take place in the way kolams are drawn today, it seems to be difficult to precisely define a kolam.

Dr Rani Siromoney and her colleagues have used the higher mathematics concept of Graph Grammar to create many kolams, and published research papers. A recent article says that this concept reduces the drug design time considerably. Dr Nagata of Japan and some other foreigners are doing research on kolam. We will see about these things in the chapter on kolam and higher mathematics.

We asked the newly arrived ChatGPT, which uses artificial intelligence, to write a sonnet, and then a poem on kolam. It did. It is based on the information it has about kolam in English. We can infer that it has quite bit of knowledge about kolam. This is just a tip of the iceberg. It is going to change the world quite a bit, can be seen from the way it responds even in these initial stages. It is challenging even to think what it will do in the future. There is one more sonnet it wrote. It is also given below. We can easily see the error in that. It was made to keep the rhyme. Very young baby. It is natural to make errors.

Oh, Kolam, how you grace the threshold's ground,
With intricate designs in white and red,
A sacred art that has forever bound,
A tradition that has never lost its thread.

Each morning, before the sun rises high,
Women of the house draw you with great care,
With rice flour, they weave patterns that belie,
The beauty and meaning that you do bear.

For you are more than just a decorative art,
A symbol of welcome, of joy, and peace,
You bring good luck and drive away ill fate's dart,
And your geometric shapes never cease.

Oh, Kolam, how you embody life's essence,
A humble form that exudes grandeur's presence.

Kolam, Kolam, on the floor,
A beautiful art that we adore,
Drawn with rice flour, white as snow,
Creating patterns that glow and flow.

Intricate designs, oh so fine,
Each one unique, a masterpiece divine

Amidst the morning dew and rising sun,
A canvas awaits the skilled and deft hand,
A tradition passed from mother to son,
A practice that transcends time and land.

The kolam, a sacred art of the south,
Drawn with precision and graceful curves,
A symbol of prosperity and truth,
A welcome sign for guests it serves.

With rice flour and vibrant colors bright,
The patterns weave a tale of ancient lore,

A symbol of culture, tradition and might,
An art form that leaves one wanting more.

Oh kolam, a beauty to behold,
A tradition that never grows old.

We checked whether ChatGPT can draw kolam. We asked it to draw a 5 x 5 kolam. It said that it didn't know how to draw. It added that anyhow it will tell how to draw. It made a mistake and told us how to draw a 5 x 2 kolam. Young baby. It had tried. Its response is given below.

I'm sorry, as an AI language model, I cannot create visual content. However, I can explain how to draw a kolam with 5 x 5 dots.

A kolam is a traditional South Indian art form that is drawn with rice flour or chalk powder outside the homes every morning. It is believed to bring good luck and ward off evil spirits.

To draw a kolam with 5 x 5 dots, you can follow these steps:

Start with a clean and dry surface. You can draw a kolam on the floor or a flat surface.

Take a piece of chalk or rice flour and draw five dots in a straight line horizontally. The distance between each dot should be equal.

Draw another line of five dots below the first line, keeping the distance between each dot equal.

Connect the first and the fifth dot of the top row with a curved line. Similarly, connect the first and the fifth dot of the bottom row with a curved line.

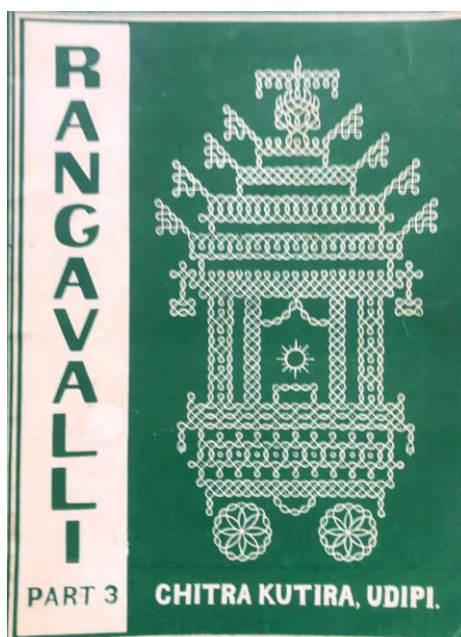
Connect the second dot of the top row with the fourth dot of the bottom row using a curved line.

Repeat the same process with the second dot of the bottom row and the fourth dot of the top row.

Finally, add some decorative elements like petals, leaves, or other designs to complete the kolam.

Remember to be creative and have fun while drawing a kolam. Happy drawing!

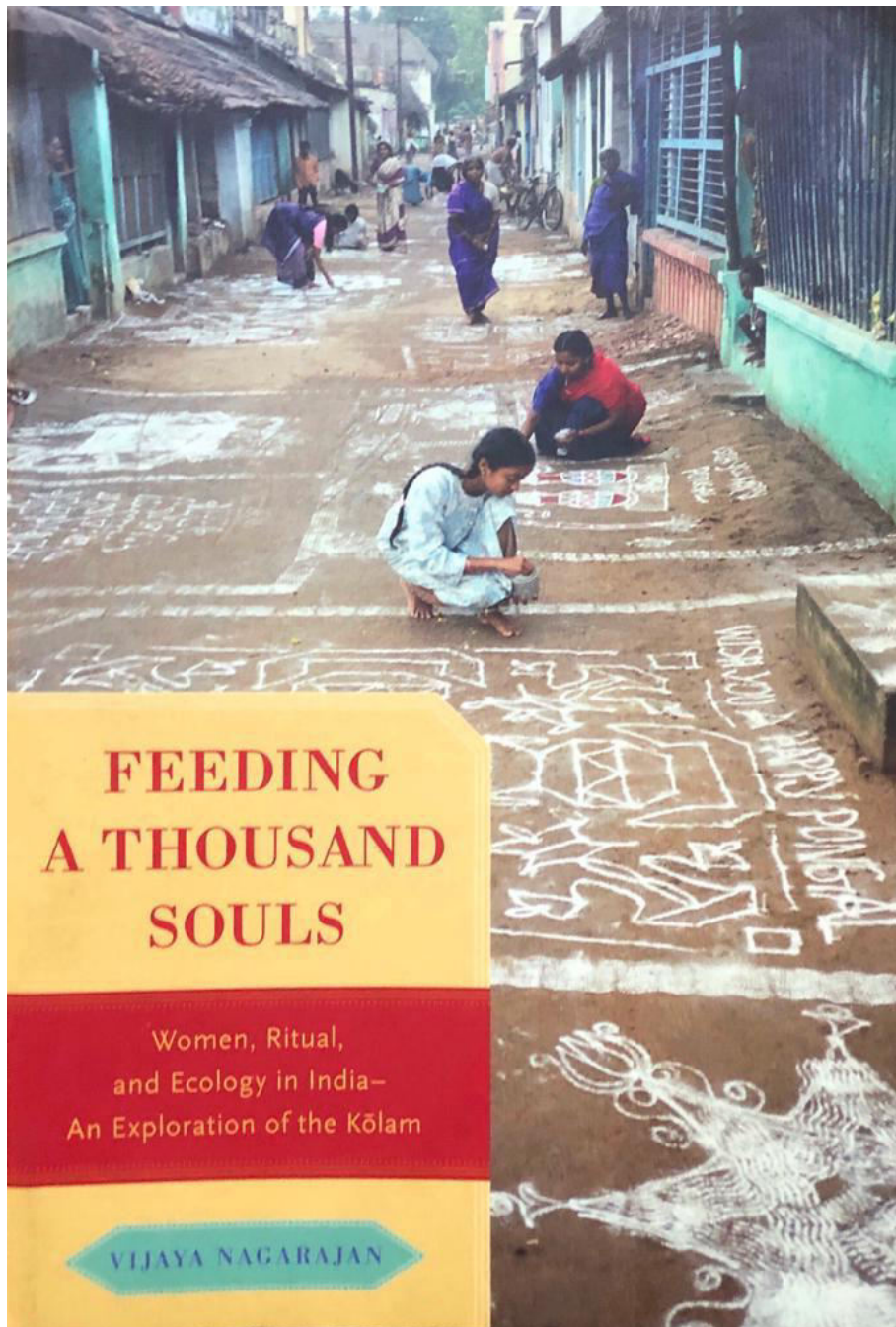
Current Kolam books



When you say 'Kolam Book' it meant a book containing kolams. Many publishers bring out such books nowadays. One notable series of 12 books in this category is by Bayiri from Udipi. They are now available in online stores. These contain mostly straight dot kolams. In cross dots we have some kottu kolams only. They are some kolam books published in Hindi also. The manufacturers of Idayam gingelly oil used to give out nicely printed books on kolam and rangoli.

Books about kolam have started coming. In 2004, Muthu Shanmugan published a book under the title 'Kolam in Tamil Civilisation'. This is a compilation of papers presented in the conference with the same title conducted at the Thanjavur Tamil University, during March 24, 25, of 1989. His student Saroja did Ph.D., under him during nineteen eighties. She has submitted her thesis on Kolam, to the Madurai Kamaraj University. We think that this is the first research thesis on kolam and culture. The author has studied the various kolams drawn by different caste persons, their differences, their beliefs etc. We do not think that this thesis is published as a book. In her Tamil book 'Mannin Manam' she has one chapter on the history of kolam. She has published 3 volumes with the title 'Thamizhar panpaattil kolangal'. In that she has given some information about kolams in some places. She has also written a book entitled 'Naattuppura varaithal kalai', which contains a chapter on kolam. Combining the incidents which occurred during her visits on field survey for her thesis, she has written an interesting book titled 'Kala aayvil kolangal'. There are only very few information regarding kolam in this book. One information is that there are kolam sculptures in the temple in Aavudaiyaarkovil.

In the Yema Dharman kolam, there is a house with four doors. One set of people draw this kolam with the south side door open, and the other doors closed. Another set of people draw it with the south side door closed, and the other doors open. None of them have any explanation for this difference. When the information gets passed from one person to the other, in one place the words open and closed have changed. This has then continued generation after generation.



Ms. Vijaya Nagarajan of USA has written the nice book 'Feeding a thousand souls : women, ritual and ecology in India - An exploration of the Kolam' in English. In that she has given the

information she had collected in her extensive tours in Tamilnadu regarding kolam and its connection with culture. She has added quite an amount of pictures in that. When the kolam is drawn using rice powder, many insects feed on that. The title reflects this. Today most of the households use rock powder to draw kolam. Very few who can afford it, and who have broad mind use rice flour to draw kolam.

In 2016, Arvind Kumar Sankar has published the book 'Pulli kolam and creative mind'. In this he gives the way in which 5 by 5 kolams are created using Savi Thambirasu method.

Kolam in film songs Kolam in TV



In the beginning of every episode of the TV serial 'Kolangal', a new rotating kolam will be shown. This serial was produced by Vikadan group, and shown in Sun TV. The kolam from the 1367th episode is shown here.

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கோலமிடுவது கோழி கூவுமுன்னே; கோபுரம் காண்பது கதிரவன் பின்னே

நீ தடுக்குக்குள்ளே பாய்ந்தால் நான் கோலத்துக்குள்ளே பாய்வேன்

நீறில்லா நெற்றி பாழ்; கோலமில்லா முற்றம் பாழ்

திலகமில்லா நெற்றி பாழ்; கோலமில்லா முற்றம் பாழ்

நெற்றிக்குக் குங்குமம்; முற்றத்துக்குக் கோலம்

பூமிக்குத் திலகம் கோலம்

புள்ளிக்கோலம் பார்த்தா, வள்ளி துள்ளிக்கிட்டு வருவா, வயித்துப் பிள்ளையோட

வேகாத நெல்லை விரலாலே கீறிக் கோலமிட்டேன்; சாகாத பிள்ளையாக வரந்தர வேண்டும்

ஏற்கனவே மாமி பேய்க்கோலம்; அதிலும் கொஞ்சம் மாக்கோலம்

Kolam in folk songs

அடுப்பை மெழுகி அணிவர்ணக்

கோலமிட்டு -

நாட்டுப்புறப் பாடல்கள். சமூக ஒப்பாய்வு, சரஸ்வதி வேணுகோபால், மதுரை காமராசர் பல்கலைக்கழகம் வெளியீடு, மதுரை. (முதற்பதிப்பு, 1982. பக் 239)

கோலங்க போட்டோம் - என்

கூடாரத் திண்ணையிலே

சிங்காரக் கோலமிட்டேன் - என்

திருவீதித் திண்ணையிலே

- நாட்டுப்புறப் பாடல்கள். சமூக ஒப்பாய்வு, பக் 253

மழை பெய்த வாசலிலே

மண்ணையைப் பிள்ளையில்லை

கறிக்கரைக்கும் தேங்காயைக்

கையேந்தப் பிள்ளையில்லை

முற்றத்துக் கோலத்தை

முன்னழிக்கப் பிள்ளையில்லை.

- கிராமியப் பாடல்

தங்கப்பொடி நுணுக்கி

தரையிலே கோலமிட்டா

தரையாலே போறவுங்கோ

தங்கப்பொடி யாருதுன்னா

தடமோ சருக்காருது

தங்கப்பொடி எங்களுது

வெள்ளிப்பொடி நுணுக்கி

வீதியில் கோலமிட்டா

வீதியாலே போறவுங்கோ

வெள்ளிப்பொடி யாருதுன்னா

வீதி சருக்காருது

வெள்ளிப்பொடி எங்களுது

- நாட்டுப்புறப் பாடல் - சொல் ஒன்று வேண்டும் - அனுராதா ரமணன்

Kolam in riddles

1. திண்ணையிலே பூத்திருக்கும் தேவர் கதை ஒன்று;

கல்லை உடைத்து வாயில் போட்டால் கர்ணன் கதை இரண்டு;

வேரைப் பிடுங்கி வாயிலே போட்டால் வீமன் கதை மூன்று

(கோலம், தேங்காய், வேர்க்கடலை)

2. முத்தத்திலே நட்சத்திரம் பூத்திருக்கு; அதைச் சுத்திச் சூரிய வட்டம் காச்சிருக்கு (கோலம்)

3. மிதிச்சாலும் மிதிக்காது (கோலம்)

4. முத்துக்களை செதரவிட்டு, மொகப்பெல்லாம் வேலி கட்டி, செகப்புத் தொப்பிய காவலாக்கி, முத்தத்திலே நிறுத்தி வச்சா, மாடமெல்லாம் விளக்கெரியும், வீடெல்லாம் செல்வம் செழிக்கும். (செம்மண் கோலம்)

5. தரையிலே போட்ட பாய்; அதைக் கிழிக்க முடியாது. (ரங்கோலி)

Today there are software to draw kolam fast and easily. They can be printed with high quality. This helps the media. When you search 'kolam' in the web, you get hundreds of sites with thousands of kolams. These can be seen under kolam and software in a later chapter.

Thus kolam is highly pervasive today. So we may say that this is the golden age for kolam!

Some may think that one important item has been left out in this chapter. Yes. It is done deliberately. 'Kolam and beliefs' is that topic. Beliefs can be put into two categories. One is like what kolam to put on what day. This is individuals belief and does not affect others. These beliefs have been studied under the title kolam and culture. The articles in the book generated from the seminar on kolam and culture in Thanjavur, Dr Saroja's research and Dr Vijaya's book all deal with this aspect. So we do not repeat them here.

The other one is exploitative. There are too many people who believe anything without questioning, if a particular person says, then it should be correct. This tendency has been exploited heavily. There are stories about which kolam is suitable for which day, which kolam is liked by which God, which kolam is suitable for which place, and which time, what will be the benefit for drawing this kolam etc. without giving any reasoning, and depending upon the fertile imagination of the story teller. There are many persons, organisations and magazines who benefit from such stories. Since it is a crime to give prominence to these, we have deliberately avoided this.

3. Kolam and myself - 1

From young age kolam has fascinated me (Leela Venkatraman). Before the age of 5, before going to school (In those days only 6 year olds will be admitted to first standard. There was no LKG or UKG in those days.) in the month of Marhazhi, sisters and aunties in the neighbouring houses will gather in the afternoon, to discuss about who will draw what kolam. In the big halls they will draw samples of what they intend to draw in the next morning using maakkal. When the drawing is over they will do changes according to their imagination. Then the kolams will be drawn in a notebook or paper. If there are school going children then the unused pages from the previous year notebooks would be converted to notebooks for this purpose. When this session is over the floor will be wiped clean with a wet cloth.

Before the kolams are wiped out, myself and my younger brother Sethumathavan (aged 3 years at that time) will draw the kolams above them. When not done correctly, we used to erase with hand, and wipe the hand with our shirts. This sometimes got us some beating from our mother. We knew that something is happening, but not exactly what. In other months usually elders play game like pallaanguzhi and thaayakkattam. They used to give us some tamarind seeds or cowries so that we will not disturb them. Only after 7 years we used to show more interest in the curves and lines they make in the kolam. Then we were given a small amount of kolam powder, and a corner space so that we could draw our own kolams there. My brother and myself will draw circles and lines of our liking.

They were not using chalk piece to draw kolam, since it has to be purchased from a shop. Also all shops will not have it. In those days sambar will be prepared in maakkal vessels. They are used to keep idly batter and pickles. If a maakkal vessel falls down, it will be broken into many pieces. These pieces will be carefully collected and preserved and used to draw kolam. One broken maakkal vessel will help many to draw kolams. When I went to Belur and Halebedu in 2003 on a tour, I saw that they sell maakkal lamps and ornamental articles in shops.

When I was doing my fourth standard, when Marhazhi came, I used to ask my mother to draw small kolams in my slate. The next morning I will also get up early and draw my kolam in one corner.

In our villages and towns, the first thing that happens every morning is to sprinkle the front of our houses with water, clean the floor and draw kolam. Even after Maarhazhi, I used to ask my mother and draw kolams. But on Tuesdays and Fridays only my mother used to draw kolams. In those days, manai kolam will be drawn, without using dots. In the middle and on the outer boundary semman (red soil) will be put. They will look beautiful. In this manai kolam, instead of drawing one line at a time, two (or more) parallel lines will be drawn together. This is called pidiyidu kolam.

You have to draw both the lines together. There are two ways to do this. One line between the thumb and the index finger, and, one line between the index finger and middle finger. Keep the kola powder in the hand and allow it to flow through these two places. This is a slightly difficult process. The other way is between the index and middle finger, and between the middle finger and the ring finger, This a bit easier. These come by practice. These are taught to me by my mother, She used to draw beautiful kolams. My first guru for kolam is my mother. Only because of her I got fascinated by kolam, and interested in drawing many kolams.

When I came to Watrap, to my in-laws house, Sethunarayana Perumal temple was just opposite to our house. My relative in the next house used to draw kolam in front of the temple everyday. In the month of Marhazhi, two elderly ladies used to get up around 2 AM, and clean the front side using water. My relative asked me to draw big kolams in front of the temple, saying that I draw kolams beautifully. Thus I got the privilege of drawing kolam in front of the temple in 1959. In Marhazhi, the bhajanai group will start at 4:30 AM, go round three streets and end at the temple itself. If the kolam is beautiful, they used to look at it for some time and go. My husband noticed this. Since it used to be lonely at 4 AM, my husband also will wake up and sit at the cement bench at the front of our house, half awake and half asleep. He will note if any error is there and point it out for correction. His intention was that anything done should be done perfectly.

Because of that, for me it became a habit that we should do anything without attracting adverse criticism from others. When we went for different places due to my husbands transfer, in the new place I used to get many new friends only in Marhazhi. During this month when we finish our daily routine of cooking, four or five neighbours together used to go

around the street to see who has drawn big and beautiful kolams. We used to discuss about improving the kolams seen to make them more beautiful.

In the school teachers used to tell that we should not copy. I followed that in drawing kolam also. In Marhazhi, elderly ladies used to come to the temple to see the kolam. In those days there were no kolam contests. Learning a craft will drive your worries - these words I like. I learnt tailoring from my mother, in tune with these words.

I was devastated when in 1978, unexpectedly my husband was killed by the impact of a bus, when he had gone to buy milk. At that time I used to participate in the kolam competitions conducted by the Mangai magazine. Though the kolams were correct, it was rare to get a prize, since the prizes were given by lottery method when the correct entries are many. In the 12 contests I got the prize of five rupees once, though I had given correct answers many times. Mr. Savi Thambirasu was the person who conducted the contest. In 1979, when he came to Madurai, he wrote to me, and those who were participating in the contest from Madurai. He informed us that he has come to dedicate kolams in the Meenakshi amman temple. He asked us to contact him if we are interested in learning kolam.

When I read that letter, I thought 'I myself can draw so many kolams. More than that what he is going to teach'. It was more than year my husband had passed away. I had not gone out during this period. This was an opportunity to contact the outside world. So, I met him at the Fatima college. There, he told me that he is going to teach kolam at the Meenakshi amman temple free of cost. I can learn if I come there. I went to these classes with my mother. He took classes for 5 days, half an hour per day in the evening. He taught how to draw kolams with 5 by 5 dots. He introduced 7 kolams with the names sa, ri, ga, ma, pa, tha, ni. Using these, he built 2,240 kolams with four side symmetry. He showed how to create 1,33,280 kolams using connections inside and outside. The next week came Thiruk Karthikai. He wanted to dedicate one lakh kolams to Meenakshi on that occasion. For this each of his student has to draw 500 kolams. These students are those who learnt kolam from him in the ladies clubs, colleges and Meenakshi temple.

500 kolam in five days meant 100 kolams per day. With me my sister in law Sethu Bai also learnt there. She was a music teacher in a school. She could not get leave. Hence I had to

put 1,000 kolams. We were told that these kolams will be drawn as maakkolam. To put the dots evenly, kolam master created papers with evenly perforated dots. These had 5 by 5 dots. Using these the dots were put first. Then after removing the paper, the kolam has to be drawn with chalk piece. Then over that the kolam has to be drawn again using thin rice powder paste.

At that time we were residing at Railar nagar, at the outskirts of Madurai. I used to go to the temple around 6:30 in the morning in the town bus. Kolam master used to be there by 6 itself. He will tell where to draw the kolams. I will draw dots for 20 kolams in one iteration. Then I will draw the kolams with internal and external joints.

My mother will start after completing all the household work, and after my brother, sister-in-law, my son and daughter, all have gone to work and school. She will come around 10 AM, by town bus, with lunch for us and the rice flour for drawing the kolam.

If we draw kolam where devotees walk, it will get erased very soon. So we used to select places on the side, between the pillars. We did kolam using rice flour ground with water for one day. Half of that got erased by the end of that day itself. The next day, when we went to draw, a long time devotee who used to come to the temple daily, brought a can of white paint. He gave it to our kolam teacher and said, 'if you draw using paint, it may last long. Why not try this?'. So on the second day itself we started drawing with paint. Our teacher thought of giving the paint first to a person who does a good job of drawing. So he chose me and gave me the paint.

Initially it was slow to draw using paint. My mother, my uncle Pitchai (who got retired just then), his wife Amma Ponnu, my brother who took two days leave, my sister-in-law after the school hours, and my daughter after her college hours, came to the temple, and painted above the lines drawn using chalk piece. On one or two days we had only banana as our lunch. On the fifth day, around 5 PM we completed 1,000 kolams. Then an idea struck me. It will become 1,008 if we put 8 more kolams. We did that also.

In those five days many relatives and friends of those drawing the kolams came to the temple, and gave some encouraging words. No one known to me came. I was sad a little bit.

If some one had come, may be there would have been some delay in drawing the kolams, is another thing.

When I finished the 1,008th kolam and got up, I saw my school friend Susila staring at me. She has seen me as a married lady. Now she was seeing me as a widow. She was shocked to see me like that. Slowly she asked 'Are you from Aranthangi?'. I could immediately recognize her. Then we talked a lot.

All the paint used on the third day has been bought by another sister. She was also a student of our teacher. Being a devotee of Meenakshi amman, she wanted to continue the beautification of the temple.

During thiruk karthikai, colorful drawings in the ceiling and beautiful kolams on the floor with lakhs of lamps shining, made it to wonder whether it is heaven. In two days after finishing lakh kolams, teacher called all those who took part in drawing the kolams, and gave certificates. Only on that day all those came together. Our teacher has been running an organisation called 'kavin kalaik kazhzhkam' in Coimbatore. Mrs. Rukmani Rajan, wife of Mr. PTR Pazhanivel rajan was the secretary. Mrs. Soundari amma, a relative of Mrs. Rukmani was the treasurer. The certificates had the signatures of these two. At that time, our teacher introduced me as the person who sacrificed food and drew thousand and eight kolams. I could not forget this till today.

Kolam sisters

Rukmani sister, Soundari sister, her younger sister Mrs Lalitha Sankar, whom I met in Meenakshi temple are the people who became my sisters through kolam. I could not forget them even in my dreams. When I write this (2015) friendship of 35 years has made us as one family. These are the people rare to get. When I was confined to my home, with my tailoring, these are the people who brought me to the outside world.

Only 5 x 5 kolams were taught at the temple. Then he came to Fatima college every month and taught different types of kolams. He taught at many ladies club also. For those who attended classes at Meenakshi temple, he took classes for ten days, one hour a day, in a kolam student's house near the temple. All the students were from the city. I was the only one staying outside the city. I used to go by city bus. We were taught how to draw big kolams, rangoli, kolam above water, kolam below water, and how to draw kolams differently depending on the available space. It included both straight dots and cross dots rangoli.

It was our teacher who started drawing kolams using paint in 1979. He used his students to draw kolams at nearby temples. Normally, some who see our kolams used to say 'They have put suzhi kolams'. They won't know how much information has gone into those kolams. My kolam sisters thought that it will look beautiful if we drew kolams just before navarathri every year, as pandal and lighting at the temple during that time will add glitter.

Within an year or two, World Tamil Conference took place at Madurai. Since many visitors from other countries were expected, we decided to decorate the temple with kolams. Every time we drew kolams, teacher used to come to Madurai and guide us in drawing big and new ways. Lalitha sankar did all the arrangements. She took care of all the expenses for paint, lunch, coffee and tiffin.



I used to think of her devotion to Meenakshi amman. Those who drew the kolams were mostly her relatives and friends. My mother used to say that we should have had some relationship in the previous births, and that is why they have called me for this venture. My mother and Lalitha sankar's sister Soundari Amma used to paint over the lines drawn using chalk piece, very quickly. No one else could do that beautifully with such efficiency and speed.

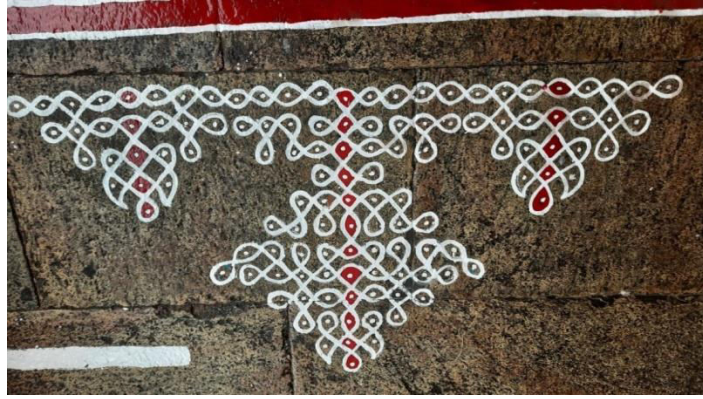
My mother used to come with me to many temples during 1,979 to 2,001. In 2,002, even though she was not well, she came for a day to draw kolam. Her enthusiasm for kolam has aroused my interest in kolam. At times, except during navarathri, sister Lalitha sankar used to take us to different temples of the family deities of her relatives to draw kolams. Also to many other temples. These include Thiruppathi, Sringeri, Sankarankoil, Thirunelveli, and Pillayarpathi. Till our teacher was in good health, we used to go under his leadership. From 1,995 we used to go on our own, since his health deteriorated.

From 2,017, Mrs. Meena Chidambaram is doing all the arrangements to draw kolams in many of the Chettinadu temples. Some of the kolams we drew at the Meenakshi amman temple are shown below.









Kolam with lakh dots

When our teacher taught us to draw big kolams, he mentioned that even if there are a lakh of dots, we can draw a kolam having just one continuous line. I asked him whether he has drawn a kolam with a lakh of dots. He replied 'I have done that in my imagination. Time has not come to do it physically.' Then a thought struck me. Should I do it? When I discussed with my kolam sisters, it was felt that if we draw on paper it will not last long. The paper will tear at the folds. We decided that drawing on the cloth is the best option. At that time fabric paint was introduced and was becoming popular. So I decided to draw on cloth.

I purchased 18 meters of white longcloth. Cut it and made it into a 12 feet by 12 feet square sheet. Tailoring learnt from my mother was handy in doing that. Decided to do a 325 by 325 straight dots kolam. $5 \times 13 = 65$; $65 \times 5 = 325$; $325 \times 325 = 1,05,625$. Decided that it should look the same when viewed from all the four sides, and should be made up of a single curve. It took just an hour to decide all these.

5 by 5 kolams are the basis for this big kolam. If we put them in a 13 by 13 grid, and connect them properly, we have a 65 by 65 kolam. If we put them in a 5 by 5 grid, and connect them properly, we have a 325 by 325 kolam. It has 1,05,625 dots. The way we choose the small kolams, and the way we interconnect them will assure that the kolam looks the same from all the four sides and it is made up of a single curve. It took about a day to decide the small kolams and the interconnections.

The distance between two dots is 1cm. Using graph paper, we put equi distant dots. To put all the dots it took 10 days. Kolam was drawn in many parts, one part at a time. Each part had to be first drawn using pencil. It had to be ascertained that it adheres to the decided design. This had to be done extremely carefully. Only when we were satisfied, that part will be painted. We did not paint directly, since correcting an error was not an option. The total time taken from starting of the design to completion of painting took 3 months. I used to paint from 8 am to 6 pm. Whenever I used to take some rest, my mother, my daughter, my brother, and my sister-in-law did the painting depending on their available time.

We had to take the paint one spoon at a time, mix with thinner, and paint from that. We could not mix in large quantities, as the paint will dry soon. Today it is not so. At that time completion of the kolam was the only thinking in my mind. I feel happy when I think of those days now.

When I finished the kolam with a lakh of dots, I showed it to my teacher. His joy knew no bounds. 'You have fulfilled my imagination and dream'. He was surprised to see one of his students to have done the job with so much dedication. 'You can get a degree first and then do a Ph. D. in kolam' he said. I said that I was not interested in that. Using the the knowledge gained from him, I wanted to draw many different kolams. He was disappointed. I drew that kolam in August, September and November of 1,981. In November that year there was an exhibition of kolam and rangoli in Chennai. It was guided by the teacher. This kolam was first exhibited in that exhibition.

Kolam exhibition

**தமிழ், சமஸ்கிருதம் பிற ஆந்திய மொழிகள்
ஆராய்ச்சி நிறுவனம்**
19, மார்கல் சாலை, எழுமூர், சென்னை-8.

**கோல ரங்கோலிக்
கண்காட்சி அழைப்பிதழ்**

அன்புடையீர்,

வணக்கம். இந்தியப் பண்பாட்டை வெளிப்படுத்தும் கவிமிக் கலைவகை கோலக் கலையை அனைவரும் கண்டுகொடுக்க ஒரு கனடா ரிஷய இந்திய மொழிகள் ஆய்வு நிறுவனம் ஏற்பாடு செய்துள்ளது. இக் கண்காட்சியை, அரசவைக்கலைச் சன்னதாசனமும் புழப்பெற்றவரும், மங்கை இதழிக் கோலப் போட்டி நடத்தியவரும், மதுரை, திருப்பதி உள்ளிட்ட 76 கோலிக் கலையில் இடைச்சக்கனக் கோலிக் கண்காட்சிப் போட்டி நடத்தும், சி ருங்கேரி சங்கராச்சாரியாரும் பொன்னுடை போர்த்தப்பெற்றவரும், ஏழாபிரம் மானகிக் கண்காட்சிப் போர்த்துமான திரு. சாணி கம்பிராசு அவர்கள் 19-11-81 ஆம் தேதி மாலை 5 மணி முதல் 80-11-81 வரை அமைத்தத் தருவிசூர். இக்கோலிக் கண்காட்சியில் தீமேக் கோலிக் கண்காட்சி, தீர் அடி ஒலியக்கள், தீர் இடைச் சித்திரக்கள், 105825 புள்ளிக் கண்காட்சி ஒரே கோலிக் கண்காட்சி, மாபெரும் கோலம், சங்கோலிக் கோலிக் கண்காட்சி, மனகோலிக் கண்காட்சி, பாட்டி கோலிக் கண்காட்சி, தஞ்சைச் சித்திரம் முதலியன இடம்பெறும். கோலப்போட்டிகளும் வருப்புகளும் தடைபெறும். சென்னையில் இக் கோலிக் கண்காட்சி யாரும் கண்டிராதவை. இவ்வரிய கண்காட்சியை அனைவரும் கண்டு களிப்படைவாவும், இந்தியக் கலைகள் போர்த்தும் அன்புடன் அழைக்கின்றோம்.

இப்படிக்கு,
டாக்டர் ஆறு. அழகப்பன்,
இயக்குகர்.

தொலைபேசி: 811909

கண்காட்சி காலம் 10 மணி முதல் இரவு 8 மணி வரை உள்ளது.
(கண்காட்சி அமைத்துள்ள நிறுவனம் ஏதிராசு கல்லூரி, சாஜாத்தினம் ஸ்டேடியம், ஏர் இந்தியா இலையகளுக்கு அருகில் உள்ளது.)



The exhibition was there for 15 days. Myself and my mother stayed in my brother Krishnamurthy's house in Chennai, and along with other students from Chennai, we prepared the drawings for the kolams and rangoli. Our teacher himself drew Tamil annai. We did rangolis to represent the five land types kurinji, mullai, maruthm, neithal and paalai, and things like Thanjavur temple tower. Also we did,

below water and above water kolams. Though I was not interested in rangoli, I took part in that activity and did Thanjavur temple tower. First we drew the pictures using chalk pieces. Then we using sieves, we spread the color powder, while sanding. After some corrections by our teacher the rangolis had come out beautifully. Ms. MathiOli Saraswathy, a student of teacher came with her students and took part in creating kolams. The Governor of that day Mrs Santhi Sathik Ali, inaugurated the exhibition. Thousands of students and general public visited the exhibition. I am on the left and our teacher is on the right in the photo.



In Puthuvai

In Puthucheri, they started the Puthuvai artist's association in 1,980. Our teacher had conducted kolam classes in Puthucheri. He had told them about the kolam with lakh dots. They invited me to the prize distribution ceremony for their second year kolam competition. On 12th February 1,982 they presented me a shield with the title 'Thamizhaga kolach selvi'. This happened in the Sri Vedapureesvarar temple. The lakh dot kolam was exhibited there. When I was coming out, one elderly lady said 'You did this kolam!' and kissed me affectionately. I can't forget that day. I was wearing a sari with kolam painted on it.

In Puthucheri, around August 15th, they usually conducted a painting exhibition. Th association president Mr. Ifar asked me to come for that. He also asked me to draw Bharathiar in kolam, for presenting them to the three dignitaries. That was the hundredth year celebration of the poet. I did the kolam and made it as a wall hanger, as per the suggestion of our teacher. The second picture has the lakh dot kolam in the background. Our teacher is with me.

On sixth November 2,016, in the mupperum vizha of Puthuvai Artist's Association, they honoured me with the tile 'Bharathi thilagam'.

In 1,986, for ten weeks, there were interviews of kolam artists and the kolams they had drawn, in the Tamil weekly magazine Ananda Vikatan. My interview and the kolam with a lakh dots found a place in that. Many people who saw that congratulated me. In 2,017 and 2,019 there were news articles in Dina Malar and UTube. Many who have seen them used to tell me that they have seen me in the paper/computer.

During 17th, 18th and 19th of March 1,983, we drew kolams at the Marutheesar temple of Thiruvidadimaruthur, for celebrating the sixtieth birthday of Mr. Pollachchi Mahalingam. Our teacher had come with his wife and daughter. Along with some of his students, myself and Mr. Thiagarajan were also there. When we were about to return, our teacher gave each one of us Rs.150. He told that they have paid for brush, paint and for drawing. That is why he was giving. That is the only occasion we got money for drawing the kolam. That was also under compulsion. Otherwise till today we do the drawing as a voluntary service only.

Mr Arvind Kumar, son of Mrs Lalitha Sankar is running an organisation in the name LAMPS, in remembrance of his mother. In 2,015, in a meeting arranged by him, at the Lakshmi sundaram hall, he honoured me. I had drawn a manai kolam and a kolam with dots, for printing in the thaamboolam bags, given in the weddings of the two sons of Mrs Lalitha Sankar. That was in 1,996. In 2,003, when her first daughter-in-law Mrs Vinodhini celebrated a house warming ceremony, she created wooden trays with the pulli kolam printed on it, and gave them as return gift.

I am continuing drawing kolam in temples even today. In August 2,022, we have redrawn the kolams at the Meenakshi amman temple.

First we started drawing kolams in temples in 1,979 Kaarthigai month, for the big kaarthigai. The next year there was the World Tamil Conference in Madurai. We did a lot of big kolams in the Meenakshi temple, and in the Madurai University. About 40 of us did it for about 10 days. Our teacher was there to guide us. I learnt a lot of intricate things from him at that time.

Questions from ladies

In the early days of our kolam journey, many ladies who come to the temple used ask these questions. Can we also come to draw? We also know suzhi kolam. How much remuneration they will give? Will they provide food?

Some will go on saying Oh. They are drawing suzhi kolams which we draw. Some will ask, are you drawing these kolam to fulfill any vow? Usually in Marhazhi, when big kolams are drawn in front of the house, the drawing is done on paper first, and then draw the kolam the next morning. Based on that some will ask with wonder how you are drawing such big kolams. If someone wanted to learn kolam from the teacher, we will take them to our teacher. He has gone to many places in Tamil nadu and also to cities like, Puduchery, Mumbai and Delhi, and taught kolam concepts, usually through Tamil sangams.

Mrs. Santha Narayanan

When we drew kolams at Madurai university, rangoli expert Mrs. Santha Narayanan had come with her students to draw rangolis. The images of leaders, mat, bed spread and rupee note are some of the rangolis they did. We did leaders images and pulli kolams on water. Mrs. Santha Narayanan told us that 'when rangoli is mentioned my name will be mentioned. Like that your teacher is well known for kolam.' We took photographs with her and our teacher.

The intricate view of an American

In 1,979 when we first drew a lakh of kolams at the Meenakshi amman temple, our teacher had taught to some kids from a hostel in Thirunagar. Using them, in one night, he had drawn a 55 by 55 kolam in the temple. It had only one line. It was a surprise for us, his students. Next time when our teacher came to Madurai, he showed us a letter. It was written by an American tourist who had visited the temple. There was a picture of the kolam drawn by the kids. There was a marking on that indicating an error. We were surprised at the involvement of that American in kolam, and his minute observation. From that time we used to be extremely careful about the correctness of what we draw.

Snake kolams

In the Meenakshi amman temple, in the inner passage of Sundareswarar sannidhi, near the Sundaraanandar sannidhi, we drew a snake kolam. It was drawn such that the body used to go above and under the crossing line alternately. We drew a snake with five heads in one place. It was beautiful. Similarly we drew that 40 dot snake kolam at the Thirunelveli Nellaiappar temple. It was on the left side of the big nandhi which was in the swamy sannidhi. They dug a small pit and fixed marbles (goli kundu) in the place of eyes of the snake. The devotees who came there moved without stamping on the kolam.

In sankarankoil, when we saw a big place outside the Sankaranarayanar sannidhi, we decided to put snake kolam there. Even after half an hour, we could not put the 40 dots in a circular fashion correctly. Then an official of the temple who was watching us came to us asked what kolam we were trying to put. We answered 'snake'. He suggested that we draw snake kolam in the swamy sannidhi and not there. His suggestion was to draw a manai kolam at that place, since it is the place where Gomathi amman's wedding ceremony is used to take place. We took his advice, and drew a manai kolam there. After that we went to swamy sannidhi. Near the thuvaja sthambam we drew a snake kolam with two snakes. We put the dots correctly in one go. No one walked on the snake kolam. From then on we used ask which function will take at which place, and then only decide what kolam will be drawn at what place.

In Madurai, some devotee has told that if we walk from the head of the snake to the tail our sins will be wiped off. Some of those who heard that started walking like that over the snake kolam. A queue had formed. A crowd gathered there to see this. A person who has seen this went the husband of my

kolam sister and told him that putting a foot on snake is a sin, and it should not happen. So, when we repainted the next time, we drew a lotus flower over the head. Now the snake became a creeper with a lotus! Since erasing paint from the stone base was bit of a problem, we simply painted over the head.

Auto fare

It was around 2,005. Many of our teacher's students were afraid of drawing the kolam with chalk piece, as they may do mistakes. They used to prefer painting over the lines drawn with chalk piece. So persons who can draw correctly were on demand. We were told that one lady who is residing at ahrini apartments, where my brother also was living, draws kolams nicely. She prepared paintings professionally and sold it in malls. I personally went to her house and requested her to come to draw kolams in temples. She agreed and told that we should provide the auto fare, for which we agreed. We thought that we should put colored kolams along with normal kolams to make it more pleasing, We selected the places straight from amman sannidhi till thuvasthambam, and from the backside of viboothi pillayar sannidhi to the entrance of amman sannidhi. In these places, we chose the area between the pillars, and drew these kolams alternately. That sister also brought two of her students. They also painted kolams. When we were chatting during lunch time, she said that when she came to this temple along with her mother-in-law, when she was newly married, after seeing the kolams we had put, she thought whether she would be able to draw kolams like that in the temple. We thought of finishing the work the next day. Usually we start the work around 10 AM and finish it around 5 PM. When that sister came the next day, she told us that her husband has told her that 'you had been longing to draw kolam in that temple for so many years. It is a boon that they themselves have called you to do it. I will give the auto charge'. Later she learnt kolam in a systematic way from us, and used to come for drawing kolams whenever she was in Madurai.

1000 rupees fee

A relative of my kolam sister Lalitha sankar, thought that learning systematic way of drawing kolams is the only way to draw kolams without errors. She learnt that from me. On the first day itself she gave 100 rupees as teacher's fee. After learning, she joined us in drawing kolams at the Meenakshi amman temple. Then one day she tried to give me 1,000 rupees. I said that she had already given the fees. She said that her husband told that she has learnt to draw crores of kolams. It is worth lakhs of rupees. Give at least thousand rupees. She insisted that I take that amount, and gave it. In those days thousand rupees was a big amount.

Last days of our teacher

Our teacher is from Coimbatore. The previous day he left for an outstation, his wife was doing well. Next morning when he returned, he was perplexed to see a crowd in front of his house. It was great shock to him to know that his wife had passed away due to sudden heart attack. He lost his balance and lost most of his memory.

In December 2,000, a relative of my kolam sister arranged for kolam classes at Coimbatore, and I went. She took me to the teacher's house. It was locked. His only daughter was working as a teacher in a nearby school. She opened the house when she came for lunch. We went inside. Teacher got up

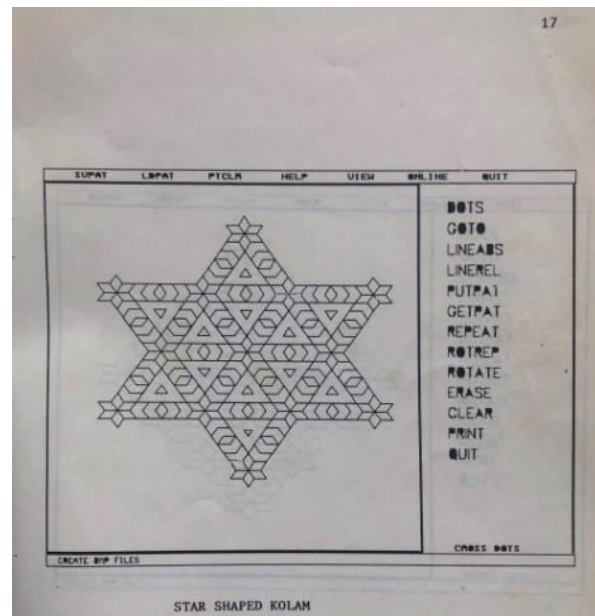
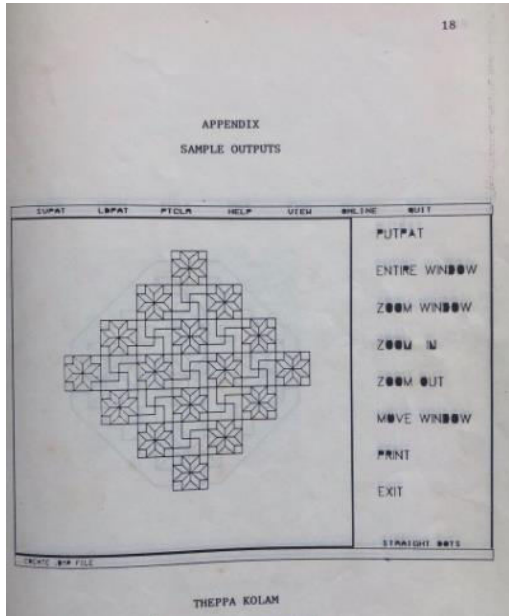
from the cot and sat down. He was looking at us for some time and didn't talk anything. I told him that his student Leela has come. Does he remember me?. Immediately he said 'How can I forget you?'. After that he did not utter a word.

'It was more than six months that my father has opened his mouth. Only today he has talked to you.' was his daughter's comment. She added that 'he will wake up whenever he wants, Takes bath whenever he likes. Eats whenever he feels so. So we keep the food on the table, and go after locking the door. We do not disturb him.' He was alive for just about four months after that.

When I drew the lakh dots kolam, he was very happy and said that I have fulfilled his dream. That is why he didn't forget me is what I think even now.

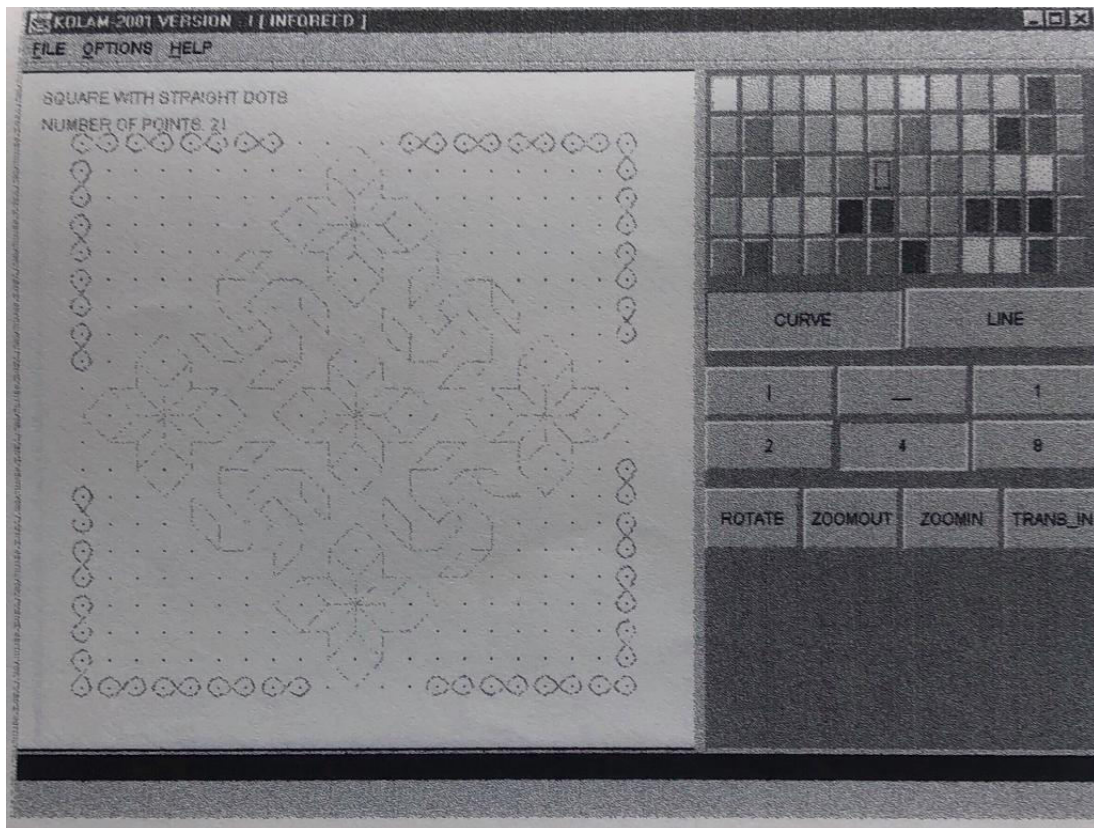
4. Kolam and myself - 2

I was in Aranthangi till I finished eighth standard. During those days, I used to go get pumpkin flowers from friends' houses to decorate the kolams drawn by my sister, during Marhazhi month. From those early days I was acquainted with kolams, and got interest in them. Later at Mullippallam, I used to help my sisters, aunts daughters, while preparing the kolams on paper, as an aid to draw them the next morning.



In Guindy Engineering College of Anna University, I gave kolam drawing as the topic for two diploma students, in 1995. Using Object Oriented Programming to draw the kolams was the idea. The main problems we faced were how to keep track of the data, and how to draw the kolam using that.

In 1997, when some students approached me to suggest a topic for doing a project during holidays. I suggested drawing kolam. I helped them also to do the project. Within a few months they went for a competition and won a prize. They were very much excited about that. In those days mostly programs were written to process numerical or text data. This was neither text nor ordinary picture. That is why they won the prize.



In 2,000, under the banner of Inforeed, Information research and education, I ran an 8 month course in Programming. Half of the students studied under 'learn now, pay later' scheme. A few students did projects on kolam in that course.

When Ms Sumitha joined me as a programmer, her training started by writing programs for games and puzzles based on kolam.

Few months before korona came, I started tinkering with the kolam software we had begun a few years before. I added the capabilities one by one. The software on drawing kolam is the outcome of that. The aim was to draw the kolams of different types. It added some new kolams drawn in the 12 volume kolam book of Bayiri. We will see about this software in a later chapter.

My sister had hundreds of kolams drawn on papers. I wanted to combine them, sort them, include the recent research on kolam and make a complete book out of it. That was about ten years ago. We tentatively identified some topics. I asked her to prepare text for these topics. After all these years, she gave me the text. Along with that she gave the hundreds of kolams she had drawn on papers, two kolam notebooks, the magazine and paper cuttings from about 40 years. This book is a product born by churning out that information. I have added the information on mathematics and kolam to that. Many of the kolam images in this book are drawn using our software.

A book which contains all the information about kolam, a software to draw all types of kolam in an easy way, a software to show different kolams each day, with a one tap method to beautify them in many ways, software for puzzles and games based on kolam, software to give exercise for putting dots and drawing kolams, a game made up of chips to play three different games, a book with about twenty lessons on systematically creating lakhs of different kolams, a coloring book for kids, with

hundreds of kolams, and, short videos on different aspects of kolam - these 10 parts make a complete project based on kolam. This package is being published now. We have created the book with a scientific view. We have implemented this in the kolam software. We believe this will increase the interest in kolam in this age. Our aim is that a person seeing this after about 50 years should view this as a complete informative package on kolam.

This package on kolam has been made possible by some incidents in my life. These happened due to the prevailing circumstances. Even if one incident has been different, this package would not have been possible. Here I reflect on them.

There was an uncle of me whose name was given to me also. He was a respected CA at Madurai, earning a lot at an young age. He passed away at an early age. Naturally I was thinking of becoming a CA on his footsteps. So I took Commerce as a subject in PUC. One day our commerce teacher commented in the class 'Should not sleep in the class like Krishnamoorthy'. I had never slept in the class. May be he wrongly gave my name thinking of some other student. But I could not take it easily. That was the end of my ambition of becoming a CA.

Becoming a scientific researcher instead of an engineer was the next step in my life. In those times, PUC, that is Pre University Course, was equivalent to today's twelfth standard. After finishing this one has to join an undergraduate course like B.A, B.Sc, B.Com, and B.E. In those days there was a requirement for joining the BE course. That is, the student should weigh at least 90 pounds. Today that condition is not there. I was weighing only 80 pounds. So I could not join BE, even though I had very good marks.

So I joined BSc in Madura College. When I was sitting in the class, some of my friends who had got less marks than me but got admission to the engineering course, came to get their transfer certificates. When I was looking at them, sitting in the class room, I was saddened. I felt very bad in not able to join the engineering course even though I had obtained very good marks.

Many advised me to take Physics as the main subject in B.Sc. May be I thought that Maths would be easier or so, I chose Maths. The college principal urged me to take Physics. I asked him, "Will doing Maths allow one to join MIT?". The answer was "Yes". My answer to that was "Then I will take Maths". MIT, madras Institute of Technology, Chennai, admitted students with science background in BSc, to a three year engineering course. There seemed to be no weight restriction there. There was a desire to become an engineer in this way.

I completed my BSc with high marks. It represented 100%, in major and minor subjects, which no one can get. The next is D+, which is from 85 to 99%, which very few will get. I got D+. I was certain to get a seat at MIT, Chennai. I got the application form. The duration of the course was 3 years. The fee was higher than that of the masters degree in science.

My father had passed away when I was about 4 years old. Already my brother was supporting me and my mother. In SSLC, since I passed with the rank of 137 in the state, I was getting merit scholarship. That helped us a lot to sail through. I decided that we can't sustain for three years with high fees. So I did not send the application to MIT.

I completed M.Sc in Maths from Vivekananda college, Chennai, in 2 years. At that time bank officer post was the coveted one. Since I wrote the required examination with absolutely no preparation, I could not get through it. That was the end of it.

The next option for those getting good marks in M.Sc was the teaching post in a college. The competition was high for that. In some places there was an one year course called M.Phil, Master of Philosophy, in Mathematics. With M.Phil degree it was a little bit easier to get a lecturer job. So, I thought of joining it, instead of sitting at home waiting for a job. I applied to Madurai University. I didn't get any reply.

At that time, my brother was working in railways at Guntakal in Andhra. My cousin was visiting us at Guntakal. I accompanied her on her way back, to her village, Mullippallam, near Madurai. From there I was returning to Guntakal. My B.Sc classmate Viswanathan came to the Madurai railway station, to send me off. On that day my M.Sc result had come. I had passed in first class. Dr Venkatraman, Head of the Department of Mathematics of Madurai University was travelling by the same train. His reservation of berth was not confirmed yet. He left his suitcase with us and went to enquire about the reservation. Viswanathan's brother was a professor in the Maths department at Madurai University at that time. Because of that Viswanathan had known Dr. Venkatraman. That is why he left the luggage with us.

In Madurai University. they had already started the classes for M.Phil. I told the professor that our M.Sc result had come only that day, and I had got first class. He asked me to send my mark sheet. I told him that I was getting Merit Scholarship till then, and I could continue my studies only if I could get that scholarship for M.Phil also. I asked whether it was available for M.Phil. He said it was available. Later I learnt that it was a wrong information. But the Professor took initiative and got us some other scholarship for a higher amount.

I sent my M.Sc mark sheet. After some days, I got the admission letter, and I joined M.Phil. One girl who had not got admission to M.Phil, had been pestering the authorities to give her admission. When they processed her application, they gave admission to me also. When I joined it was already about one month over from the starting of the classes. In the first semester there were 3 subjects. In that I could understand one subject. In the other two I could not understand what the teacher was talking about. I was worried about it. It had never been like that. On one day, when I was going to the university in the city bus, I had been worrying about this all along, and I suddenly looked outside, and realized that I had not got out in the required bus stop. I got out in the next stop.

I felt that I could not continue like that. Then a book I had read in my aunt's house at Bengaluru. It was 'How to stop worrying and start living' by Dale Carnegie. There was an important advice in that. It said that you analyze the problem, and find out what is the worst thing that could happen due to the current problem. Accept the worst, if you cannot help it. Then think of things you can do to improve the situation. If you do these things one by one the situation will improve slowly. If you think of these improvements your worries will be over and you will be rejuvenated.

When I thought of this, I decided to use this advice and see what happens. First, I thought about the worst thing that can happen. M.Phil had 5 subjects. Three in the first semester, and two in the

second semester. So, the worst thing is that I will fail in two subjects. This is not because I was not capable, it is because I joined the course very late. If I fail then I can write again and pass.

I just accepted the worst thing that can happen. Then I started thinking about what can be done to improve the situation. All the five subjects will have final examinations only at the end of the second semester. Not immediately. So, I can try to learn things from the beginning, and try my best at the final examination. That meant that there is a chance that I will pass. Now I started to study without worrying. My friends' class notes and their help helped me a lot. After the final examination, we got the result. I had passed with a first class! I had obtained good marks too!

I mentally thanked Dale Carnegie profusely. I have told this to my students many times. If you happen to read about some good advice, don't just stop at reading it. When a situation arises, using it will get you good results.

During the M.Phil days, I learnt quite a lot. What is meant by science? What is Mathematics? What is assumption? What is a theorem? What is a proof? What is a mathematical model? Is there varieties of infinities? I got answers for all these things. When I read about the current research about our universe, these things help me to understand them better. Being taught by a team of expert teachers in pure mathematics was a very rich and rewarding experience.

When I completed M.Phil and started looking for a job, Dr. Venkatraman spoke to me. He wanted me to join research. He said "Lecturer job will get rupees 450. But a research scholarship will get only rupees 250." This gave me the confidence that I can do research. But, since we had to repay some debts incurred during my studies, I could not join research immediately.

When I was doing M.Phil, Mr. Shanmugasundaram, then Head of the department of Mathematics, in a private college in Dindigul, near Madurai, used to visit the university. He wanted many of his staff members to get M.Phil degree without attending classes full time. He wanted to recruit somebody who will help in that. The principal of that college was Captain Murugaiyan. He got that Captain rank being in NCC (National Cadet Corps). I didn't know that at that time. For a number of questions in the interview my answer had been that I didn't know. When asked about NCC, I said that I was there in it for two years, because it was compulsory for undergraduate students and there was no use of that. I thought that I will not get a job there. But I got it. I came to know of the HOD's intention of helping his staff only later. I took classes on M.Phil subjects to them, in the afternoons. I was there for about an year.

In Madurai University, they used to call professors from prestigious institutes like IIT, to give series of lectures on various topics such as computer languages, operations research and graph theory, for the sake of enhancing the capabilities of lecturers in nearby colleges. Since I attended these lectures, I got acquainted with the professors who came. This kindled my ambition to do research again. Graph theory was at a nascent stage at that time. Clear thinking was the only requirement to do research in Graph Theory. So I chose that field. I got admission in IIT, Chennai.

Giving salary on the first of every month was a prestige issue to the management of the Dindigul college in which I was working. For doing research, the scholarship was about half of what a lecturer got. There was no guarantee that I will get PhD. Due to the above reasons, many of my well wishers

advised me against resigning the job and going for research. I did not heed to their advice, and boarded a night bus to Chennai. Most of the night was spent in thinking whether what I was doing was correct.

I went to the administrative office of IIT to join there. A thunderbolt was awaiting me there. The central government has frozen all appointments just then. They said that research positions were included in that. So I can't join the research program. I had resigned my lecturer post. Here they say that I cannot join for Ph.D. I didn't know what to do. The head of the department of Mathematics did not accept their argument. He argued that they cannot reject a candidate who has been already offered a position. He won. I joined as a research scholar.

Line kolam is made up of some dots, and some lines joining the dots in an aesthetic manner. If we generalize it, we get what is called a Graph. Some points and some lines joining some points. That is Graph. Beauty is not a criterion. So every line kolam is a Graph. But only some beautiful Graphs are kolams. What we see in a printed circuit board is a Graph. The connections in an Integrated Circuit called chip is a graph. Graph is used in many more places in computer science. That is why many do research in Graph Theory.

During 1973-1977, when I was doing research at IIT, there was a main frame computer called IBM 370 at IIT. Research scholars can run programs in that. The programs had to be punched in cards and given to the computer center. They will run it and return the result after a few hours. If we give the deck of cards in the morning, we will get the result in the afternoon. If we give in the afternoon, we will get the result in the evening. Many times, instead of results, we will get only messages indicating the errors in the program. We had to replace the cards with errors and submit again. In this way I got experience in running computer programs.

When I got my Ph.D, I got a job in MIT, Chennai. There I had the opportunity to teach computer languages. From there I went to the Electrical Engineering Department of Concordia University, Montreal, Canada, as a Post Doctoral Fellow, for two years. What mathematicians call as Graph, engineers call it as Network. I used the word network in my research there.

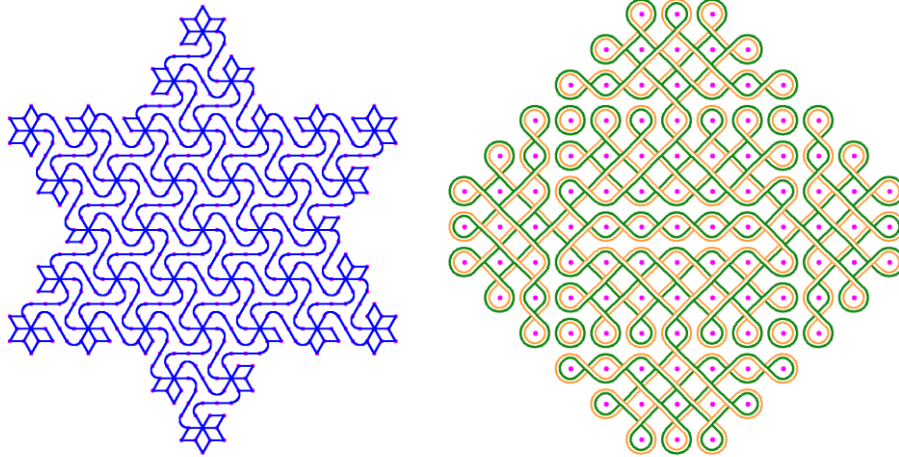
In 1978, when I returned to Chennai, I joined as Assistant Professor in the School of Computer Science and Engineering in Guindy Engineering College, which is a part of Anna University. Here I had to take only computer science subjects. So I Learnt by myself about a dozen computer science subjects. Due to this I learnt how to efficiently keep the data, and write programs running fast. In the labs, we had to deal with many computer languages, and so I became familiar with multiple languages. These things helped me in designing and executing the kolam programs.

If any of the things that I have mentioned above has not happened, my life would have been different. This kolam project would not have happened. I wanted to study in Guindy Engineering College and MIT. But it didn't happen. But I ended up teaching in these two institutions! What an irony! In life, instead of grudging and worrying about what we have not got, enjoying what we have is a better option. When one door is closed, going through an opened door may give new opportunities.

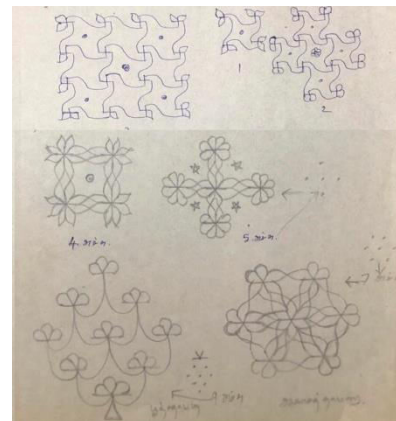
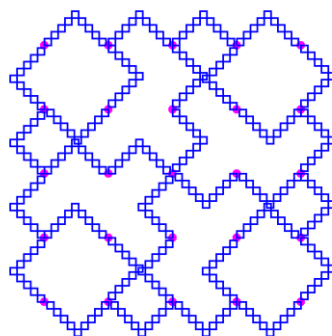
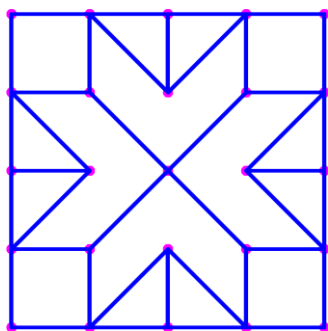
When I draw kolams in many new ways, I feel happy. Like that I felt happy when I created software like a fast spell check, handwriting recognition system and Optical Character recognition systems for Tamil. Looking back, now I feel that not becoming an engineer has been a blessing in disguise.

5. Types of kolams

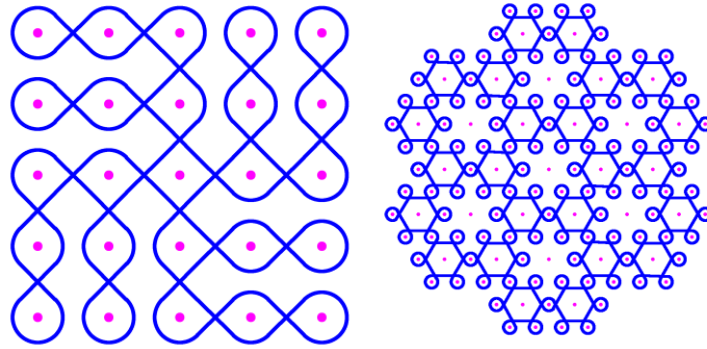
Kolam started as a beautiful collection of lines. To place the lines in correct places they started putting dots. So the kolams can be basically divided into two types, one without dots and the other with dots. Manai kolams are usually drawn without dots. They can also be drawn using dots.



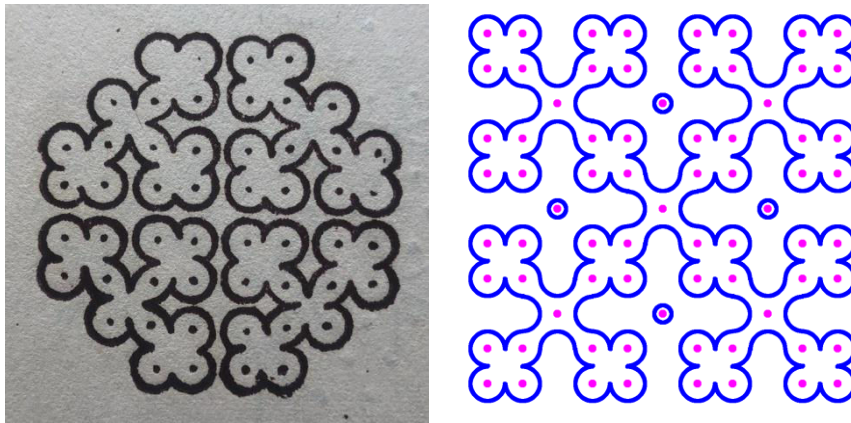
Kolams with dots can be subdivided into two types - line kolam and suzhi kolam. Suzhi(circular) kolam is also called sikku kolam, due to its intricacy.



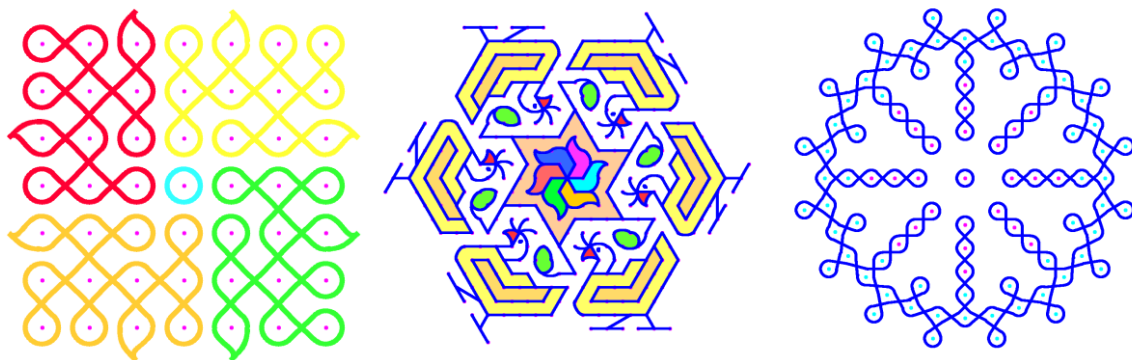
In line kolams, there are many subtypes. In the first, dots are joined by lines. These can be straight lines, or curved lines or a combination of both. In the second subtype, two dots are joined by a sequence of small squares. They are called katta(square) kolams. In the third type, the dots are replaced by one design having a few lines. These designs are joined by straight or curved lines. These are called achchu(block) kolams.



In suzhi kolam, the lines go around the dots, like a circle, without touching the dots. We can subdivide the suzhi kolam into three types based on the radius of the circle. Usually the radius is about one third of the distance between two adjacent dots. This is the first type. In the second type, the radius is about one fourth of the distance between two adjacent dots. Krishnan salangai is an example for this type.



In the third type, the radius is just half the distance between two adjacent dots. Here two adjacent circles should touch each other. We learnt about this type by seeing the kolam books by Mr. Bayiri. When we tried to implement this type in our kolam drawing software, we found a discrepancy in the kolams of this type in the book. In the kolams of this book, adjacent circles touch in some places and don't touch in some places. You don't notice this while you are casually looking at the kolam. That means that the radius is not same in all the directions. It is very easy to do this while drawing by hand. Though not impossible, it is a bit difficult to get it in computers, in a general setup. In our software we have kept the radius to be the same in all the directions.

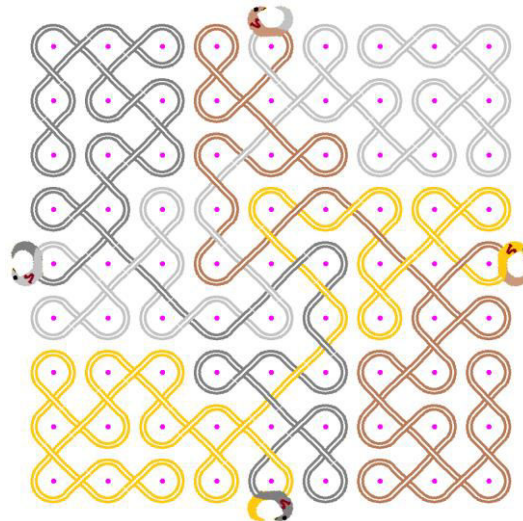


Kolams with dots can be classified in another way also. This depends on the way the dots are put. Straight dots, cross dots and circular dots are the three types. In the straight dot type, the adjacent dots will be either just above, just below, just to the right, or just to the left. The dots form a rectangle. If needed more such dots can be added on the sides.

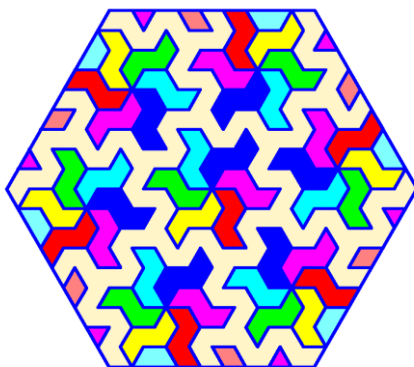
In the cross dot type, one line of dots will be in the middle of the dots of the next line of dots. In this type, usually a kolam will be in the shape of a hexagon. We can add more dots on the six sides.

In the circular dots pattern, the dots are on the radii of a circle.

In all these three types, we can have line kolams and suzhi kolams.

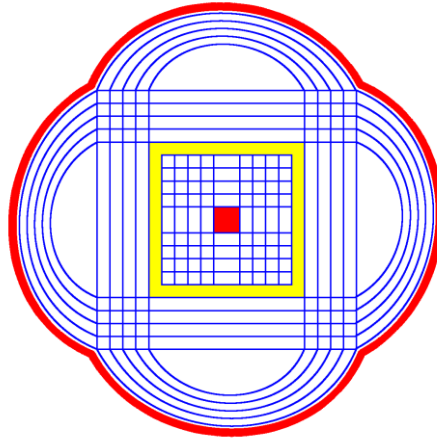


There is a special type of kolam called snake kolam. This is drawn in all the three types, line kolam, suzhi kolam and achchu kolam.

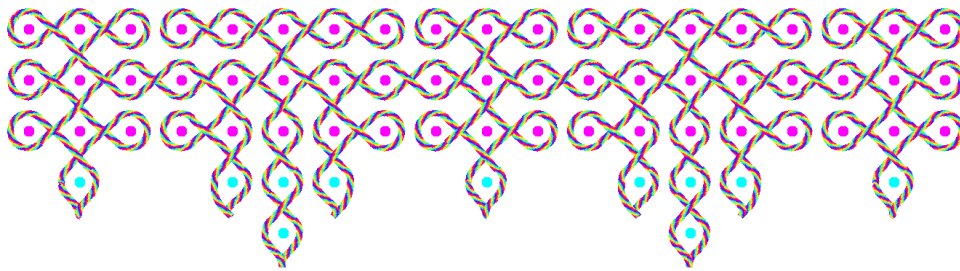


Usually the kolams are not colored. But we can color the finite closed areas in the kolam. These can be called as kola rangoli.

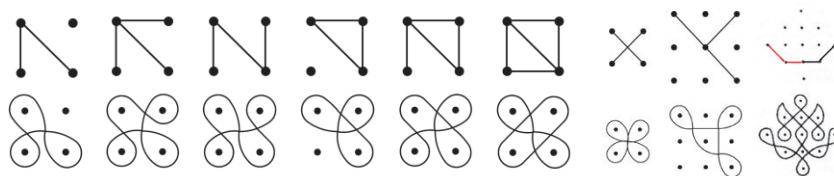
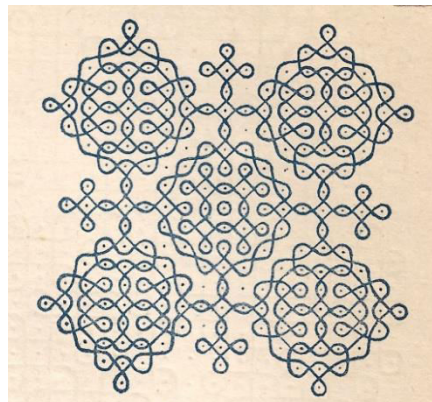
The kolams in the thresholds of the house are usually drawn using rice powder or white crushed stone powder. Rice powder can be used as it is, or, it can be used as a fluid paste, by mixing with water. Kolams drawn using the paste is called maa (flour) kolam. Apart from these husk, salt, and food grains are also used to draw kolams. Decorating like a kolam, using flowers is the specialty of Kerala.



We can also classify the kolams based on the reason for drawing a kolam, the place in which it is drawn, or the material used. Some of them are - Manai kolam-drawn on the occasions like wedding, made up of many parallel lines-, drawn in front of the house or at the pooja room, drawn during the festivals like Deepavali, Pongal, new year and Christmas, depicting the articles like swing, chair, fruits, birds, animals, and musical instruments.



The normal kolam is drawn as the main theme. There are kolams drawn at the border. These border kolams have a small number of vertical dots, and a large number of horizontal dots, or, a large number of vertical dots, and a small number of horizontal dots. The pattern repeats in the longer side. There are kolams which are drawn at the corner of a space.



Normally, in straight dot kolams, a dot will be joined to an adjacent dot which is vertically above or below, or, a dot which is horizontally to the left or right. In the first image above, you can see that some dots in the boundary, which are neither vertical or horizontal are joined. This type of slant joining is rare. Timothy M. Waring has written a research paper entitled 'Sequential Encoding of Tamil Kolam Patterns', in 2012. Here he shows how to represent mathematically these slanting joins. The ways in which these slanting joins can occur is shown in the figures which come after the first figure above.

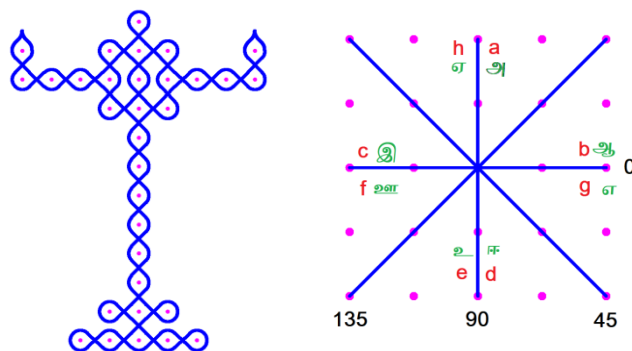
When pen, pencil were available to everyone, kolams started appearing on paper. Pencil was convenient, since it can be erased and drawn again. Almost every girl from Tamil Nadu had kolam notebooks. Paint was used to draw kolams on the floor, so that they won't be easily erased. This started from the Meenakshi temple of Madurai. From drapes, table cloths to saris, kolams were hand painted. Using the screen printing, kolams appeared on plastic sheets. These were pasted in front of the houses. Kolams were also printed on saris in this method. When printing technology improved kolams were used to decorate the background and borders of invitations.

Software for drawing kolams started coming. The fastness and the ability to do things without getting tired, along with the accurate printing of the small printers, has ushered in a new era in drawing kolams, in ways unimaginable before. It seems that we may need a new category called computer kolam!

Kolam drawing started with the floor. It beautified the frames of pictures. With the imagination of the human mind, it took shapes as kolam under or above water. Kolams were decorated further by drawing red borders. Some dots or lines like buds decorated kolam. In the villages, during Marhazhi month, large kolams were adorned with flowers of pumpkin, standing on small balls of cow dung.

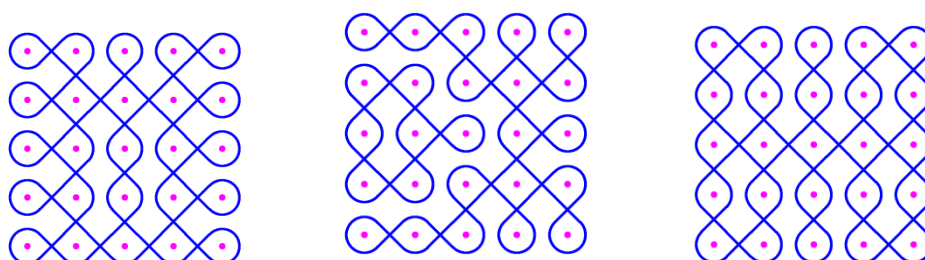
6. Symmetry in kolam

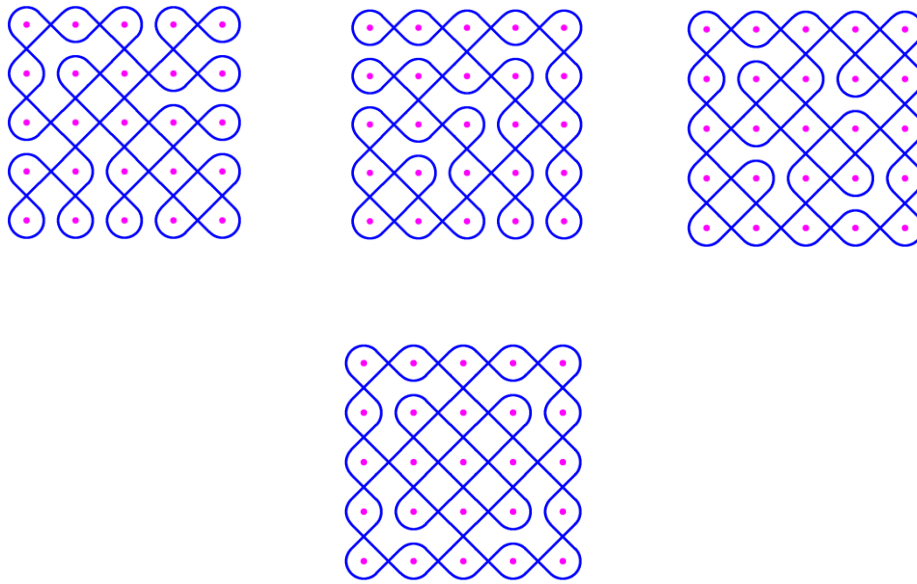
In kolam, one place being similar to another place is called the symmetry. The aim of this chapter is to give a generalized notion of symmetry in kolam. There are two basic types symmetry in kolam. Reflective symmetry and rotational symmetry. First we shall consider straight dot kolams.



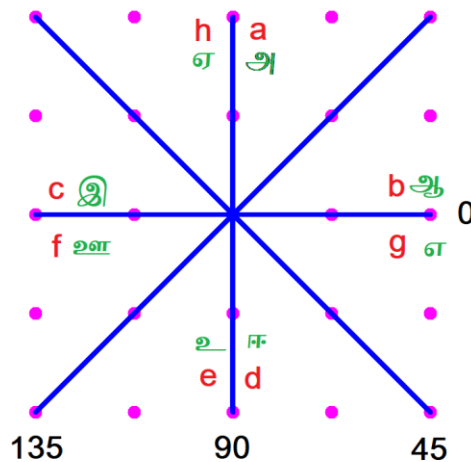
Consider the lamp kolam. If we flip it such that the left and right sides gets interchanged, we get the same kolam. We can see this in a different way also. Think of a double sided vertical mirror, kept at the middle of the kolam, with its plane perpendicular to that of the kolam. We can think that the kolam on the left of the mirror is reflected on the right side of the mirror. Similarly, the kolam on the right side is reflected on the left side. This kolam has a left-right symmetry. It has reflective symmetry about the middle vertical line.

This is a straight dots kolam. Usually such kolams have the square shape. The above mentioned mirror line can be thought of as the line joining the mid points of the top and bottom sides of the square. Similarly we can consider the horizontal line joining the mid points of the left and right sides of the square. Also the two diagonal lines joining the corner points of the square. So, we can think of four mirrors. They can be specified by the angle they subtend at the center of the square. The line going from the center to the left is supposed to make an angle 0. This angle increases in the clockwise direction. Hence, the directions of the mirrors are, 0, 45, 90 and 135. Lamp kolam has reflection over the 90 degree mirror only. We shall see some examples of kolams with reflective symmetries over the other mirrors.





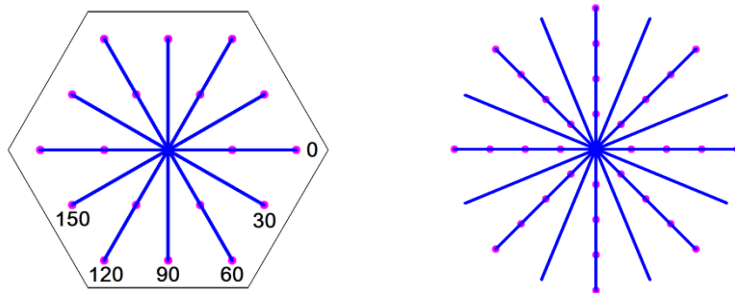
In these examples, the first one has reflective symmetry over the vertical line only. The second has reflective symmetry over the horizontal line only. The third one has symmetry over both the vertical and horizontal lines. The fourth and fifth have reflective symmetry over one of the diagonals. The sixth one has symmetry over both the diagonals. The seventh has reflective symmetry over all the four lines.



The above examples show that the four reflections are independent of each other. But if we consider one diagonal and one non-diagonal lines, we cannot find an example having reflective symmetry over exactly these two lines, and not over the other two. Think of the eight points at the places specified by the names a to h. Let us think that we need reflection only for the lines with angles 90 and 135. Point b is the reflection of point a with respect to the line 135. Point c is the reflection of b over line 90. If we reflect like this over 135 and 90 degree lines alternately, then we have all the points a to h. These points include the reflections over the other two lines also. It is to be noted that when we need symmetry over more than one line, when they combine, they can introduce other symmetries also.

Next we shall see what is meant by rotational symmetry.

One full circle is made up of 360 degrees. For example, if we split it into 4 quarters, we get 90 degrees each. So, if we rotate the kolam 90 degrees each time, at the end of four rotations we complete one full round. In this, after every rotation we go to the next side of the square. That means we see the kolam from all the four sides. If all these four views are same, that is, each time, the rotated kolam is the same as the original kolam, we call that kolam as a Special kolam. This we call as a kolam with rotation symmetry of four. If the view of the kolam is same when viewed only from opposite sides, then the rotation symmetry is two. That is, if we rotate the kolam by $(360 / 2 =)$ 180 degrees, we get the same kolam. If we do not have any of these two symmetries, then the rotation symmetry is said to be only one. For the straight dot kolams, the rotation symmetry can be only 1, or 2 or 4.

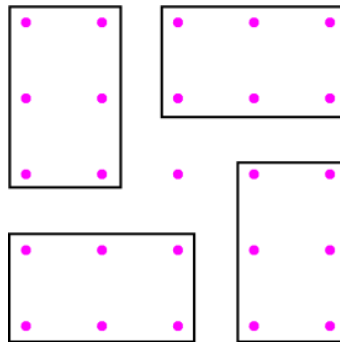


Now we will see the cross dot kolams. They usually have six sides. They have mirrors at 0, 30, 60, 90, 120, and 150 degrees. The rotation symmetry has 4 types. 1, 2(180 degrees), 3(120 degrees), and 6(60 degrees).

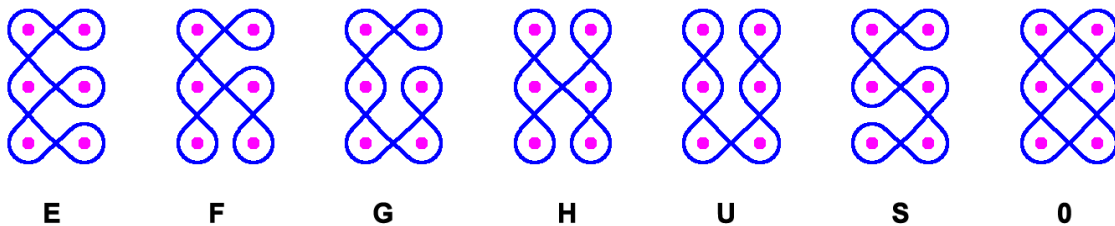
We can think of circular kolams as an extension of the six sided cross dots kolams. We can think that the part between two adjacent radii gives one side. Along with the radii, the line passing through the center of the circle, and the center of a side form the mirrors. So, for example, in a circular kolam with 8 radials, there are 8 mirror, and, the rotational symmetry can be any one of 1, 2(180 degrees), 4(90 degrees, or 8(45 degrees). In a circular kolam with 9 radials, there are 9 mirrors, and, the rotational symmetry can be any one of 1, 3(120 degrees), or, 9(40 degrees).

7. A method of creating big kolams from smaller parts

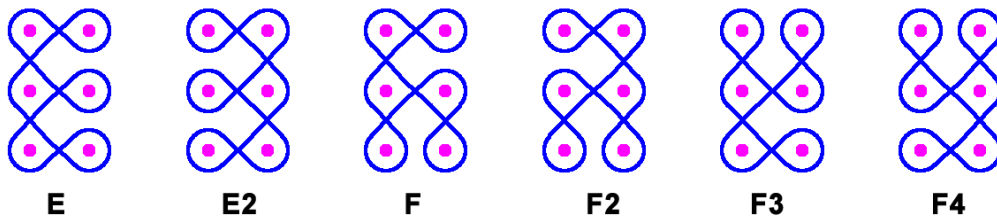
Do you remember the story on the strength of being together which we learnt when we were young? A bunch of sticks tied together cannot be broken easily. When untied and taken individually they all can be easily broken. Small things can be done easily. When a big thing is split into smaller actions each of the smaller actions can be done easily, and hence the bigger action. This strategy is being used everywhere. Today all the software are created only using this strategy. We can create big kolams by joining smaller kolams. Thousands of 5 by 5 kolams can be created in this way. This was first introduced by Mr. Savi Thambirasu. This created surprise, and enthusiasm among the ladies at that time, and was welcomed largely. First we will see what he did. Then we will generalize it further and see.

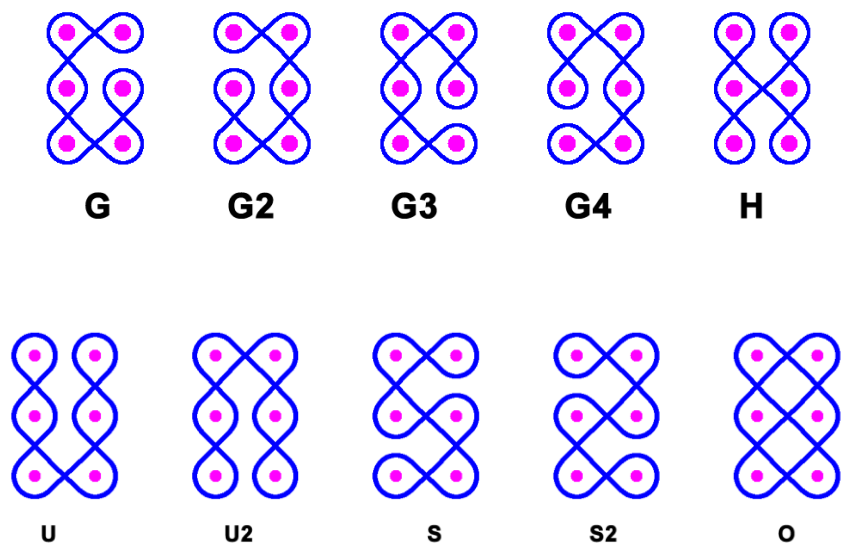


When we put four 2 by 3 kolams as shown in the figure, we get a 5 by 5 kolam. A kolam which looks the same when viewed from all the sides is called a Special kolam. We shall create such kolams here.

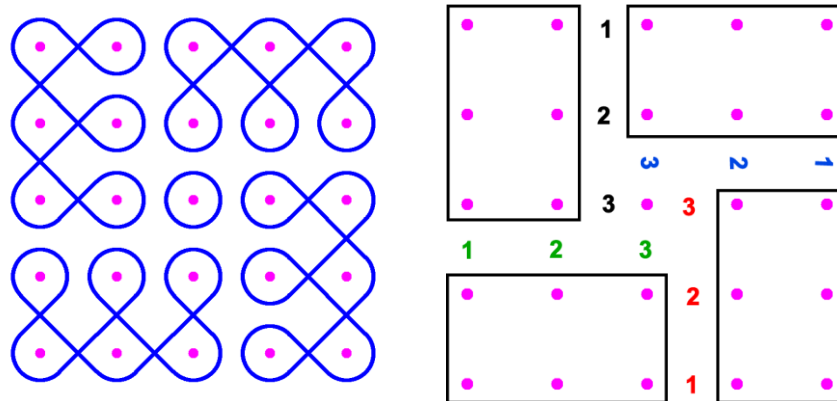


First we consider the 7 fundamental kolams of 3 dots and 3 rows as shown above. These were named as sa, ri, ga, ma, pa, tha, ni in Tamil, and as E, F, G, H, U, S, O, in English. The English names are based on the shapes of the kolams. We will use this. There is no connection between the Tamil names and the kolams except that there are 7 ragaas.

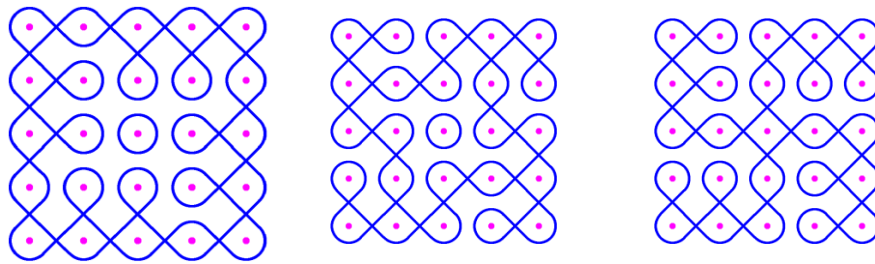




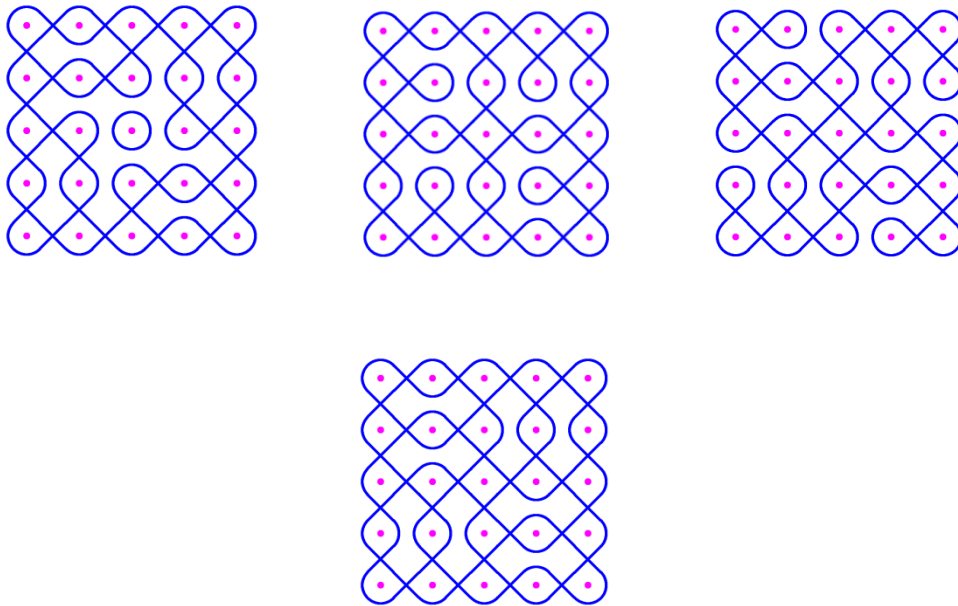
If we flip the 7 kolams interchanging top and bottom, we get 3 more kolams named F3, G3, and U2. If we flip the 7 kolams interchanging left and right we get 4 more kolams named E2, F2, G2, and S2. If we flip first in one way, and then the other way we get two more kolams named F4 and G4. This makes a total of 16 kolams. take one of them and put it in the top left position. Rotate it by 90 degrees and and put it in the top right position. Rotate it by 180 degrees and and put it in the bottom right position. Rotate it by 270 degrees and and put it in the bottom left position. This is done to make the kolam Special. Add a circle to the middle dot. Here we have 5 disjoint kolams. A kolam looks good only when there is considerable amount of joints among the circles. So we will try to join them.



The places where one part can be joined to the adjacent part is shown by the digits 1, 2 and 3. To ensure that the kolam looks the same from all the four sides, if we join in one place with a given number, then we have to join in all the four places having that number.



1

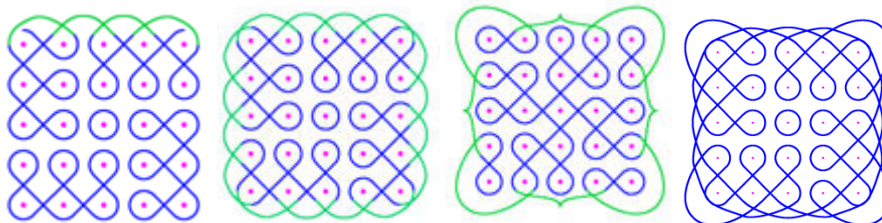


The 3 places can be joined in $2 \times 2 \times 2 = 8$ different ways. They are represented as $()$, (1) , (2) , (3) , $(1, 2)$, $(1, 3)$, $(2, 3)$, $(1, 2, 3)$. Each group tells where the joints are. Note that in the first group there is no joining. Later we will see that this can also be useful.

We see the 8 kolams formed by giving the internal joints to the kolam E, in the above figure. Using the 16 such kolams, we now have $16 \times 8 = 128$ kolams.

Now we will see how to generate new kolams using outer joints. We need to consider how the dots in the top row are joined. These joints should be rotated in the clockwise direction and done for all the four sides. This is to ensure tha the kolam is Special.

Outer joints



In the first figure above, in the top row of dots, the adjacent dots are connected. We will represent this as 0-1-1-1-1. Here the first number indicates the number of dots we jump to start the first joint. The other numbers indicate the jumps we make for every joint.

In 0-2-2 the number 2 implies that we join after leaving one(2-1) dot. 1-2-2 (third picture) implies that we start after skipping one dot, that is, we start from the second point. Here the second joint crosses the top right corner and joins a dot on the right side. In all these descriptions, the sum of the numbers excluding the first one is 4. In a 5 by 5 kolam, you can jump over only 4 dots on one side. That is why this total. 0-2-2 and 1-2-2 join different dots. These two can be combined to form a new outer joint. It can be represented by 0-2-2 + 1-2-2 (fourth figure).

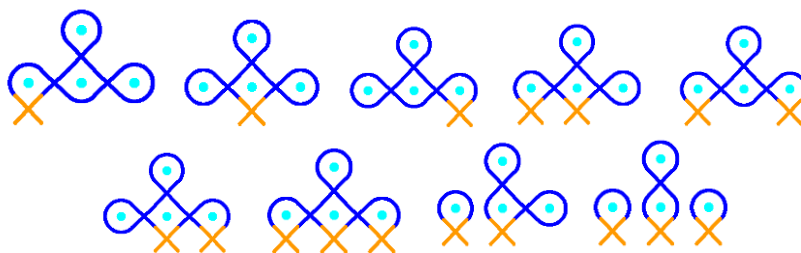
There are 30 outer joints in this method. They are -

- | | | |
|-----------------------|-----------------------|---------------------------|
| 1. 0-1-1-1-1 | 2. 0-2-2 | 3. 1-2-2 |
| 4. 0-2-2 + 1-2-2 | 5. 0-1-1-2 | 6. 1-1-1-2 |
| 7. 0-2-1-1 | 8. 0-1-2-1 | 9. 0-1-3 |
| 10. 1-1-3 | 11. 2-1-3 | 12. 0-3-1 |
| 13. 0-4 | 14. 1-4 | 15. 2-4 |
| 16. 3-4 | 17. 0-1-3 + 2-1-3 | 18. 0-3-1 + 1-1-3 |
| 19. 0-4 + 1-1-1-2 | 20. 0-2-1-1 + 1-4 | 21. 0-1-2-1 + 2-4 |
| 22. 0-1-1-2 + 3-4 | 23. 0-4 + 1-4 | 24. 1-4 + 2-4 |
| 25. 0-4 + 1-2-2 | 26. 0-2-2 + 1-4 | 27. 0-4 + 1-2-2 + 2-4 |
| 28. 0-2-2 + 1-4 + 3-4 | 29. 0-4 + 1-4 + 2-1-3 | 30. 0-4 + 1-4 + 2-4 + 3-4 |

What we indicate by jumps 1, 2, 3, 4, Thambirasu used the names thana, thaana, thanthanaa, thanthaNaa. He gave the starting position separately. We have combined both and given it in a short form.

If we give 30 outer joints to each one of the 128 kolams, we get a total of $128 \times 30 = 5,400$ different kolams.

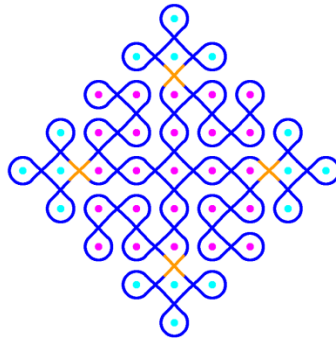
Additional dots



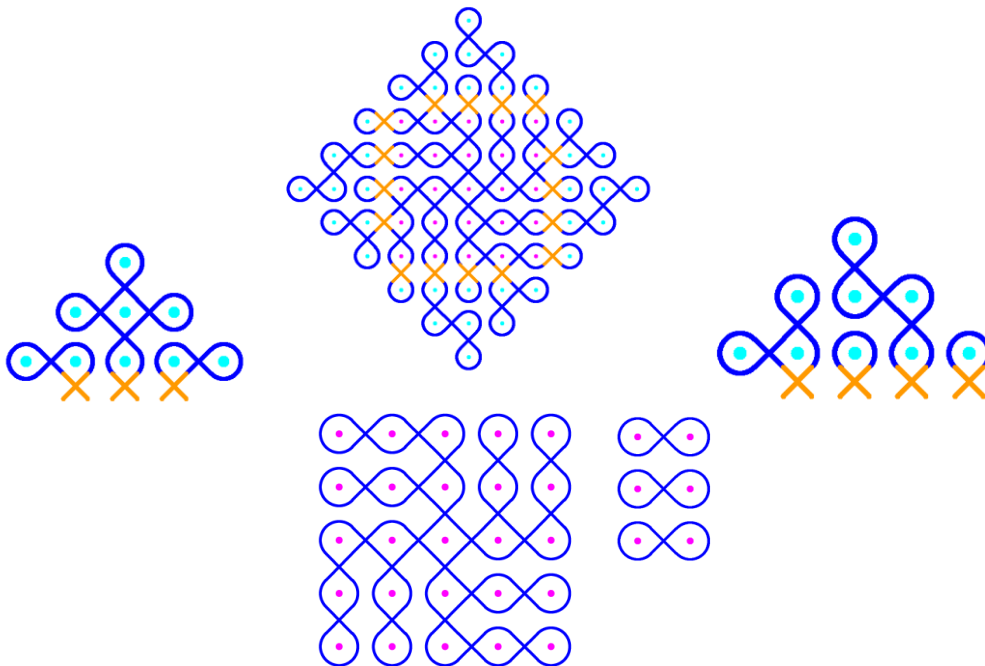
We can add a few more dots on the sides, and create many bigger kolams. First let us consider one extension using 1 + 3 dots. This will be added on all the four sides of a 5 by 5 kolam. In this let the top dot be connected to the dot below it. There are two places in which the 3 dots can be joined. There are 3 places in which the extension can be joined with the main kolam. When there is no joint between the 3 extended dots, the extended dots should be joined to the main kolam in all the 3 places. When there are two joints between the 3 dots, the inter joints between the extended dots and the main dots can be in one, two or three places. There are 14 extensions, and some of which are shown above. You can fill the remaining few.

If we add add these 14 extensions, to the 128 five by five kolams, we get $128 \times 14 = 1,792$

kolams.



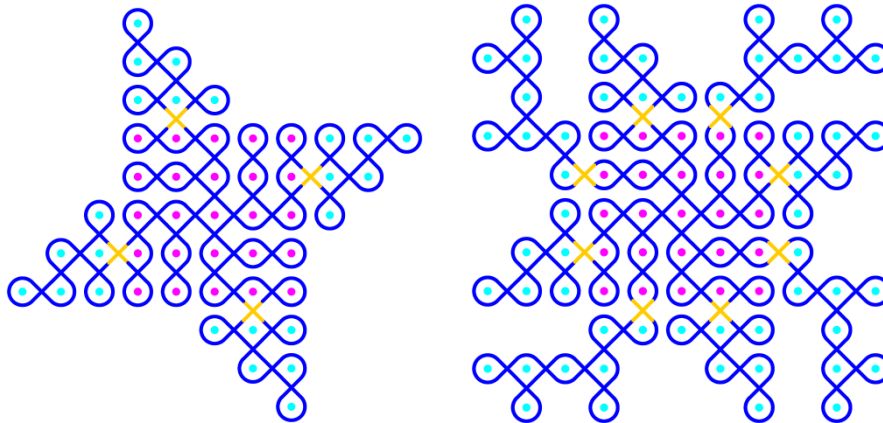
If we see these 1,792 kolams, we can see that there are 5 dots on the four slanting sides of the kolam. We can give the 30 outer joints to these kolams. This gives $1,792 \times 30 = 53,760$ new kolams!



We have seen how to join a kolam with 1+ 3 dots to the sides. Similarly we can add a 1 + 3 + 5 dots kolam with 3 rows of dots, to all the four sides. Two examples are shown above. If you have patience, you can count the number of such extensions, and the number of extended kolams which can be created using these.

Now carefully look at the main kolam in the above example. We have not used here any of the 16 fundamental kolams we started with. Instead we have used the 3 x 2 kolam in the last picture. This has 3 disjoint parts. When you give internal joints, they get connected. So, the 2 dots, 3 row kolams, the number of connected pieces can be anywhere from 1 to 6. When we give internal, inter and outer joints, there is a possibility that the resulting kolam is connected. So, we have to change our view that the fundamental kolams are only 16. A kolam's structure depends on all the factors like the starting kolam, internal and other joints, extended dots and their kolam.

When there is no extra dots, it is possible that the kolam has a single line. For example see the last but one figure.

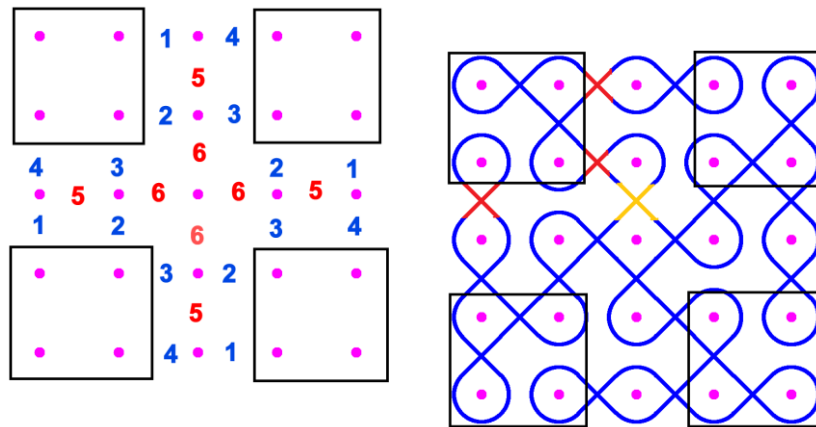


You can see an example of a kolam with a $1 + 2 + 3$ extra dots, joined at an end of the sides. This gives a kolam with a different style. Some of the kolams we have considered here starting with 2 by 3 kolams, with some extra dots, may look beautiful, and some may not be that beautiful. It depends on the perception of a person. But one thing is certain. You can create many thousands of kolams with a 5 by 5 kolam as the starting point. Depending on the capability of the person drawing the kolam, she can draw by bending the lines in many different ways. This should have been the motivating force for the young women to create newer and newer beautiful kolams.

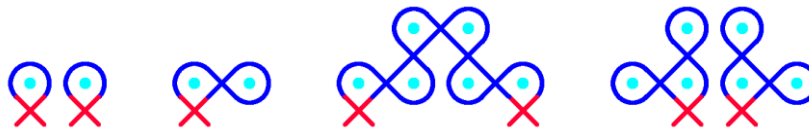
There is an important factor to be taken note of here. Some of the kolam figures shown here are drawn using the kolam software we have created. We have used the definitions such as main dots, extra dots, inner, extra, and inter joints, outer joints, reflective and rotational symmetry in the software. This was possible because of the understanding we got when we analyzed the ways in which the kolams are drawn. But the women who created the art of drawing kolams, did not know much about these. Their objective was that the kolam should look the same from all the four sides, it should look beautiful, and it should be appreciated by the residents of the street. Giving a scientific basis for the art created by them is the main objective of some of the scientists of today.

In the software, depending on the symmetry set, the software can draw multiple lines. But this is not the case with drawing a kolam on the street. When a curve is started, it is continued a while, creating many circles. This has to be done in different places differently. This is not an easy task. Utmost concentration is necessary. When an error occurs, it propagates. When an error is found out, it is a real task to find out where the error started. The error lines have to be erased and redrawn. To avoid this, the previous day itself women used to draw the kolam on paper and get ready to draw a flawless kolam the next day.

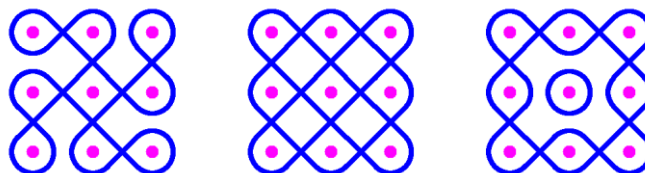
Another method



We have seen how to get a 5 by 5 kolam starting with a 2 by 3 kolam. Similar to that there is another method to create a 5 by 5 kolam starting with a 2 by 2 kolam. We use a kolam in the shape of the plus sign to bind the four smaller kolams, as shown. The two by two kolams and the plus type kolam are not connected. But note that the full kolam is connected.

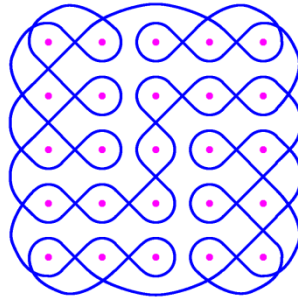


A 4 by 4 kolam can be created by joining four 2 by 2 kolams. On the four sides we can add extra dots and lines, to create bigger kolams. We can add extra dots as 2 dots in one row, or 2 + 4 dots. Some such extensions are shown above.



The above are some of the Special kolams with 3 by 3 dots. By putting together 4 of them in a 2 by 2 fashion, a 6 by 6 kolam can be generated. Whether the new kolam is Special, depends on the way they are joined. Extra dots can be added to these 6 by 6 kolams, with (2), (2 + 4), (2 + 4 + 6) dots. These can be beautiful. Extra dots can also be added with (2 + 2), (2 + 2 + 4), (2 + 4 + 4), (4 + 4 + 6) dots. Now we know how to create 7 by 7 kolams using 3 by 4 kolams, 8 by 8 kolams using 4 by 4 kolams, and, 9 by 9 kolams using 3 by 3 kolams. We can add extra dots and outer joints to these kolams. Now we know how create lakhs of beautiful Special kolams!

Opposite side symmetry

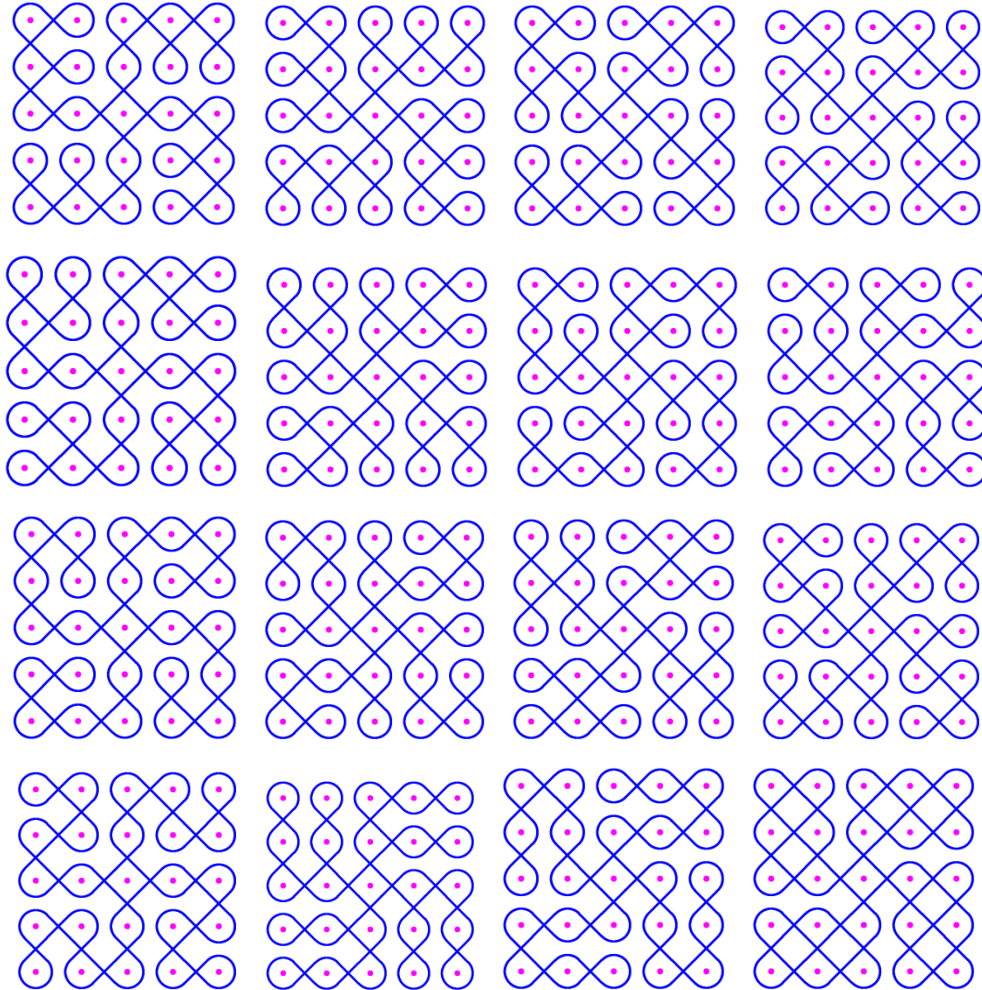


Most of the kolams we have seen till now have a rotational symmetry of 4. That is they look the same from all the four sides. They are Special. Kolam which look the same only on the opposite sides can be created using the same methods used to create Special kolams. For this of the four kolams used at the starting point, the first and third should be the same. The second and fourth should be the same. Similarly, the first and third internal joints should be the same, and, the second and fourth should be the same. In the same way, the outer joints have to be the same in the opposite sides. An example is shown above. It is obvious that there are many more such kolams rotational symmetry of 2, than the kolams of rotational symmetry 4.

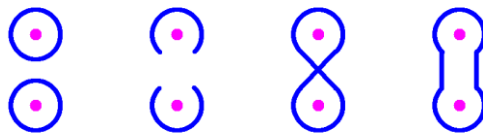
8. Kolams with lakhs of dots

In the kolams drawn on a 12 feet by 12 feet white cloth, and on the floor of Madurai Meenakshi amman temple, there are more than a lakh of dots. Here we shall see how they were designed, and the proof that there is exactly one line in them.

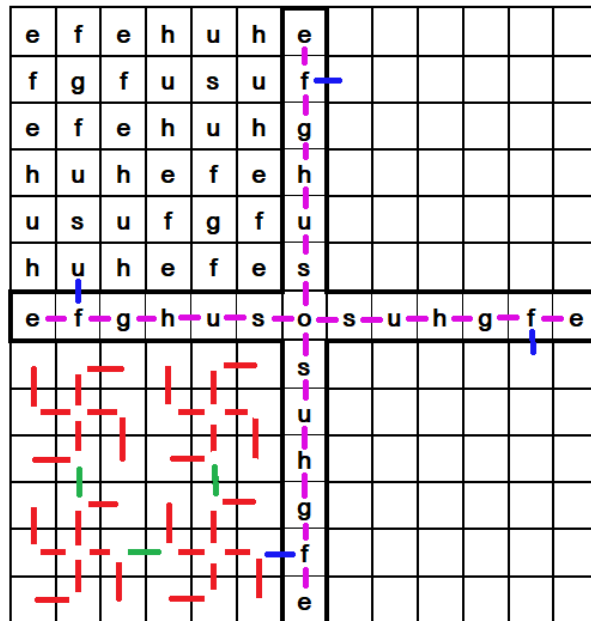
First let us consider the kolam drawn on cloth. This was entirely designed by Leela. This is based on the sixteen basic 3 by 2 kolams we have seen already. Using each one, one 5 by 5 Special kolam has been designed. Here only one internal joint per side is used. We give the names based on the basic kolam. instead of the capital letters, we use small letters. This makes it easy to remember.



We can easily check that all these 16 kolams are made up of single lines. We shall show that joining two such kolams in a specific way results in a kolam with a single line. If we do this one by one till we get the final kolam, we are sure that the resulting kolam is made up of a single line.



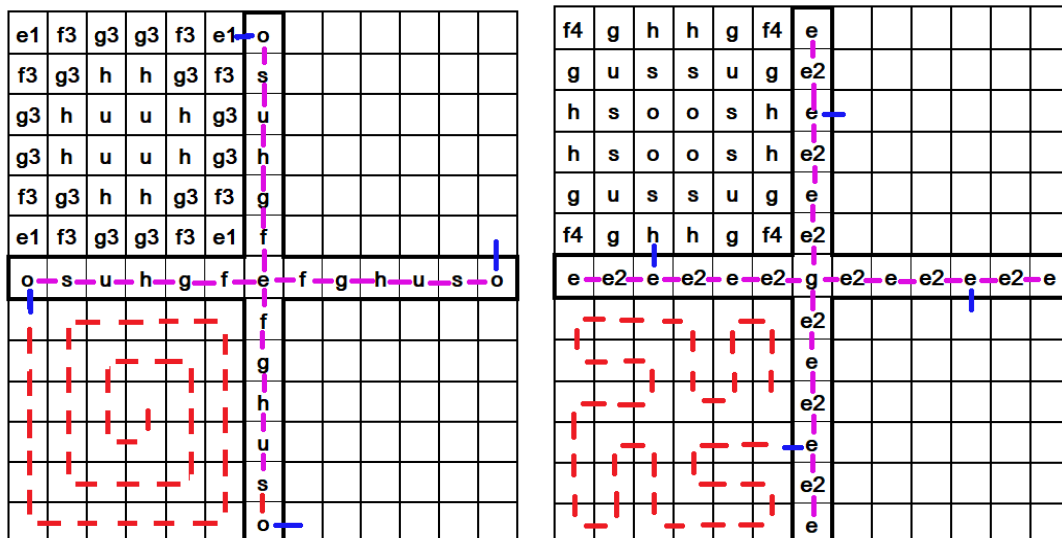
If we cut the two separate chains, as shown in the first figure, and join them by two lines as shown in the last two pictures, then we get exactly one chain. We are going to do this type of cutting and joining one after another. This assures that the final kolam is made up of one chain.



The kolam named K1 is shown above. Each of the squares in the 13 by 13 grid, represents one 5 by 5 kolam. The names of the kolams in the first quarter is given in the figure. We take the kolams in the first 6 by 6 block, as one unit, and place it in the other three quarters, after rotating it by 90, 180 and 270 degrees. The joining are shown by red, green, blue and magenta. When two kolams are joined, the arcs in the adjacent middle dots are cut and joined by two crossing lines in the form of x. First join the places shown by red lines one by one. Then do the same for green, blue, and magenta lines in that order. This shows that K1 is made up of a single curve.

In K1 there are $65 \times 65 = 4,225$ dots. Note that this is designed in such a way that it looks the same from all the 4 sides.

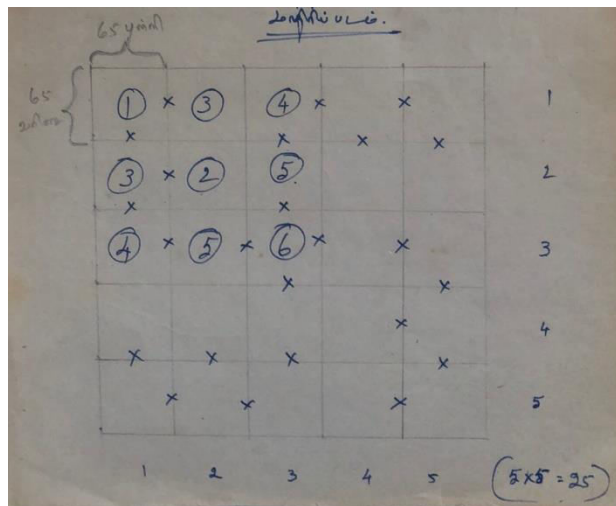
In the same way, the 6 kolams K2 to K6 are designed. They are shown below.



e2	f2	e2	h	u2	h	f2						
f2	g2	f2	u2	s2	u2	h						
e2	f2	e2	h	u2	h	f3						
h	u2	h	e2	f2	e2	h						
u2	s2	u2	f2	g2	f2	f						
h	u2	h	e2	f2	e2	h						
f2	h	f3	h	f	h	s	h	f	h	f3	h	f2
						h						
						f						
						h						
						f3						
						h						
						f2						

s	e	f	g	h	u	s						
e	f	g	h	u	h	f3						
f	g	h	u	h	g	o						
g	h	u	h	g	f	h						
h	u	h	g	f	e	f3						
u	h	g	f	e	s	e2						
s	f3	o	h	f3	e2	f	e2	f3	h	o	f3	s
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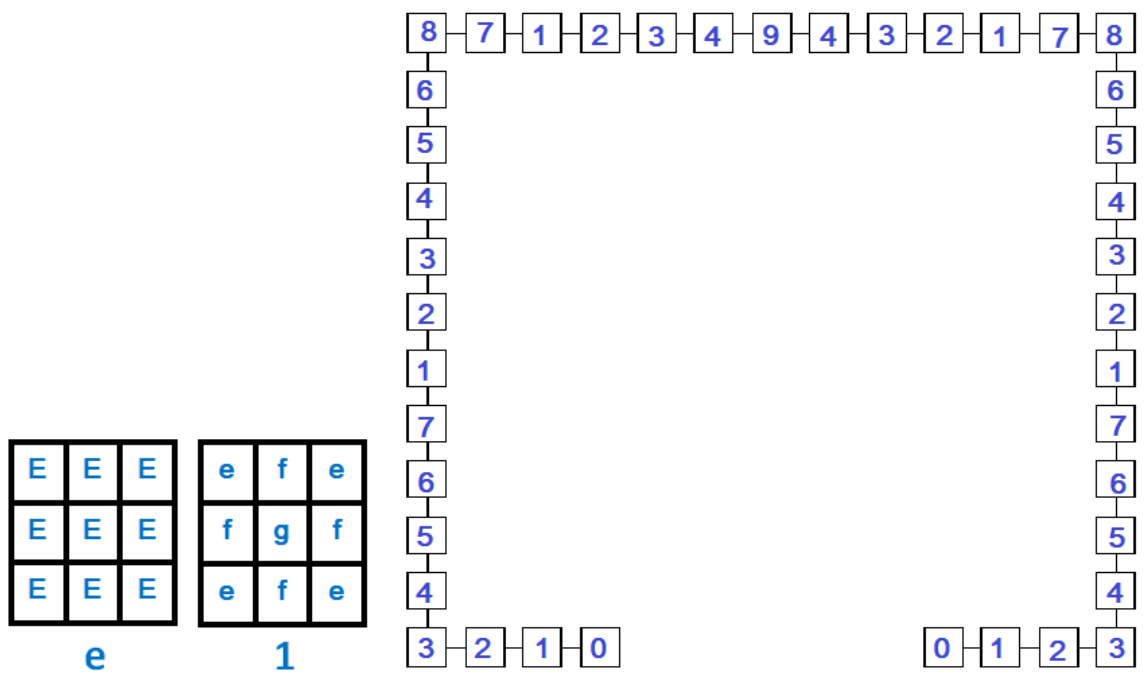
g	f	e	u	h	g	h						
h	o	s	s	o	e	o						
u	s	u	u	s	e	f2						
e	s	u	u	s	u	g2						
f	o	s	s	o	h	e2						
g	h	u	e	f	g	s2						
h	o	f2	g2	e2	s2	u	s2	e2	g2	f2	o	h
						s2						
						e2						
						g2						
						f2						
						o						
						h						



If we join these six kolams as shown in the last figure above, in a 5 by 5 grid, we get a 325 by 325 kolam. It has 1,05,625 dots. Analyzing the way the kolams are joined, we can be sure that the whole kolam is made up of a single curve. Here again we put the kolams in the first quadrant, in the other quadrant, by rotating them as a whole, by 90, 180 and 270 degrees. This ensures that the final kolam looks the same from all the four sides.

This kolam was painted in a 12 feet by 12 feet cloth. The distance between the dots is 1 cm. The dots and the lines were painted blue. This was started in the last week of July 1981, and finished in the last week of October 1981. First it was exhibited in the Kolam and Rangoli Exhibition in Chennai, during November 18 th to 30th, 1981.

In Madurai Meenakshi amman temple, we have drawn lakh dot kolams thrice, along with many smaller kolams. They were done in 2003, 2014 and 2019. Each one had a different configuration. Since we know how big kolams are generated from smaller ones, we will avoid much of the details. Around 40 ladies used to paint these kolams at a time. We shall see the structure of the kolam drawn in 2019. These kolams were designed by Leela and Lalitha Sankar.



The kolam named e is a 15 by 15 dots kolam made up of nine kolams named E. Similar definitions hold for kolams f, g, h, u, s and o. The kolam 1 is made up of the kolams e, f, and g, as shown in figure. It is referred as efg. Similarly the kolams named 2 to 7 are defined as fgh, ghg, hgh, ghu, hus, uso, soe, and oef.

The square shaped figure above shows the way these blocks are joined in the lakh dot kolam of 2019. Here each square numbered 0 to 7 represent a 45 by 45 dot kolam. The kolam named 0 is a 25 by 25 dots kolam. The square named 8 is a 75 by 75 kolam. The joining of these parts makes the whole kolam as a single curve kolam.

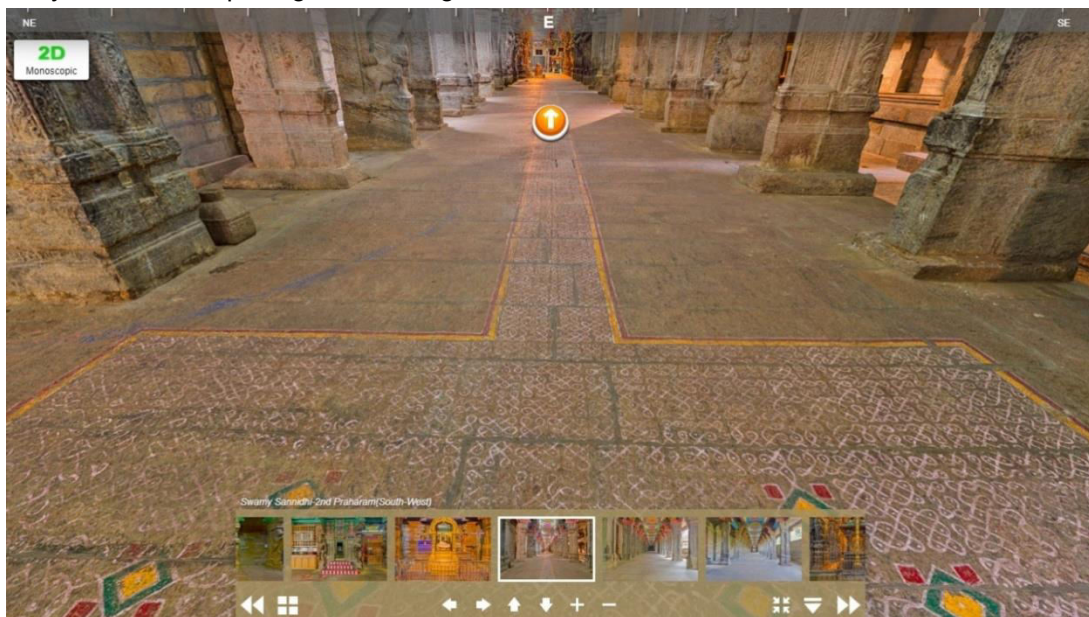
The distance between two dots is two and a half inches. The space required for a 45 by 45 dots kolam is about 10 feet by 10 feet. That is about 100 sq feet. These blocks are usually joined by 8 kolams of size 5 by 5. Due to the small variations which occur during putting the dots, there may be small variation in the number 8.

It is not an easy task to draw such big kolam, without any distortion in the positions of dots and lines, in a place where the traffic is high. We will see how this was done. First the design was done on paper, taking into account the availability of space. Decisions were made regarding which kolam comes where. Then it is to be assured that the central dots of different parts are aligned in a straight line. This is done as follows. A rope called 'manik kayiru' is immersed well in kola powder. Then it is kept straight and tight on the floor where the middle dots of the required kolams should be. The rope is kept tight on the two ends by two people. The middle of the rope is brought up as if it is the string of a bow, and left suddenly. The rope touches the floor forcefully, and the kola powder falls on the floor and makes a perfect straight line. The middle dots are drawn on this line, and then the other dots are filled in.

A big plastic sheet is taken, and horizontal and vertical lines are drawn with two and a half inches between them. Small holes are made in the intersection of two lines. This gives a sheet with holes at equal distances. This is used to identify the places for the dots with chalk piece. We start from the

place where the positions of the middle dots are identified. Successively placing the sheet with one line of holes overlapping the previously marked dots, all the positions of the dots are marked. Later they will be painted.

Next, looking at the design what kolam should come at what place was decided, and then that kolam was drawn with chalk piece. It was made sure that the required kolam is drawn correctly. Finally we started painting the dots and lines. Painting starts in the middle of a kolam and moves towards the outside. Drawing the lines with chack and paint are done by experienced persons only, because the lines have to be smooth and gracefull and of same thickness. To avoid erasing the dots and lines drawn by the chalk, usually wooden planks and thick cardboards are used to sit and draw. One has to be very careful while putting or removing these.

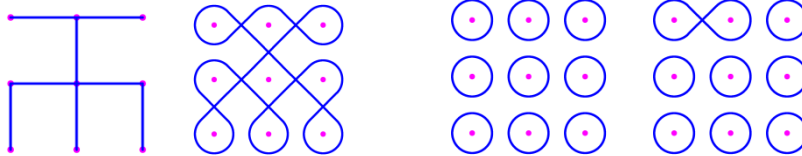


The lakh dot kolam drawn in 2003 had 75 by 60 dots kolam in the corners and 11 dots width kolam as the joining kolam. This was in the second prahaaram of swamy sannidhi. A part of this kolam can be seen in the website view360.in. A screen shot from this site is shown above. Using his website one can know about the temple and its architecture from anywhere in the world. There was an article about the camera work being done for this website, in the Madurai edition of the newspaper Dinakaran of 29-09-2013, This information is in the website. This website shows the many parts of the temple in 3D view. The screen shot shows the corner kolam in the south west corner of the second prahaaram and the joining kolam. We can see many other kolams also in this site.

9. Suzhi kolam and Line kolam are the same

Line kolams are mostly made up of straight lines. Easy to draw. But suzhi kolams are mostly made up of circular arcs. The lines go twisting and bending. These curves have to be drawn one by one. The full curve has to be in the mind. So, it is evident that these two types are different.

But the title means something entirely different, For example see the figure. First one shows a line kolam. The second one is a suzhi kolam. Let us see how to get the second one from the first.



First take a kolam where each dot has a circle (third figure). If there is line joining two dots in the first kolam, then, cut some parts of the circles with these two dots, and join them with two crossing lines like x (figure 4). If you do this for every line in the first figure you get the second figure,

So for each line kolam we get a suzhi kolam. Reversing the method, we see that every suzhi kolam has an equivalent line kolam. So these two types of kolams are fundamentally the same! Note that this is applicable only to the simplest kolams. This is not applicable where outer joints are present.

10. Nine kolam learning lessons

Mr. Savi Thambirasu, has gone to many places and conducted kolam drawing classes until 2000. These classes used to be for about 15 days, with one hour each day. One such class was conducted at the Madurai Meenakshi amman temple during 20-10-1979 to 24-11-1979, each day between 5 and 6 PM. I (Leela) attended this session. When it was over, for the first time kolams were drawn in the temple, during 25-11-1979 to 29-11-1979. Myself and my relatives drew 1,008 kolams at that time. Our teacher used to draw the lines using chack piece, and we used to paint them.

Mr. Thambirasu also taught kolams by sending lessons through post. One lesson was sent every month. Nine lessons were sent. Due to lack of time, since he travelled to lot of places, he could not continue the lessons. Brief statements regarding the contents of the nine lessons are given here. We have seen all these information earlier. As a part of our kolam project, we are planning to write a separate book on systematic way of drawing kolams, to complete the task started by my kolam teacher.

Lesson 1

Names for kolam in different areas in India. Suzhi kolam. rangoli. Sand drawing. The structures around a dot. 7 fundamental 2 dot, 3 row kolams. 9 more extensions. 4 side and 2 side rotational symmetry.

Lesson 2

Creating a 5 dots 5 rows kolam from 2 dots 3 rows kolam. The joining method.

Lesson 3

Joining a 1 dot 3 rows kolam with a 2 dots 3 rows kolam, and creating a 3 dot 3 rows kolam.

Lesson 4

Drawing a big kolam using 3 dots 3 row kolams. Getting 416 kolams by flipping 3 dots 3 rows kolams.

Lesson 5

Border kolams. One dot height kolams, with outer joins on one side.

Lesson 6

Giving outer joins on both sides of the one dot height border kolams.

Lesson 7

Creating 112 Special kolams, and 6664 kolams which look alike when seen from opposite sides. 2 dot 3 rows kolams are the starting points.

Lesson 8

Method of giving outer joints.

Lesson 9

Joining smaller kolams on the sides.

11. Material used in drawing kolam

Old literature tells that kolams were drawn using fine white sand. Nowadays fine white stone powder is being sold as kolam powder. Only this is used extensively today. Drawing kolam using rice flour is very rare. Rice flour is mixed with water to draw maa kolam. Color powders are also used now.



For drawing the kolam in front of the house, the place is first prepared by cleaning the surface and putting a thin layer of cow dung paste. To beautify the kolam, in the villages, the pumpkin flowers are used. They are kept standing with the use of small cow dung balls. You can see a picture from the DinaMalar newspaper. It shows that the hibiscus flower is also used along with pumpkin flowers.



To decorate the sides of an area, perforated cylinders are used. They come in different sizes. They were previously made up of tin sheets. Nowadays it comes as plastic rollers. These cylinders are filled with kolam powder, and rolled over. This gives repeated images. Sieves with kolam as perforated patterns are available. Small lids of bottles are also converted like this. These sieves come in different sizes. In Chennai, we can see that, during important occasions, roadsides are decorated using big sieves of about two feet diameter.

Plastic sheet stickers are now available, with kolam printed on it. Usually this is used in front of flats. This saves the time of drawing kolam everyday.

Paint is used to draw kolam on cement surfaces, so that it remains intact for some months.

To paint on fabrics, fabric paint is used.

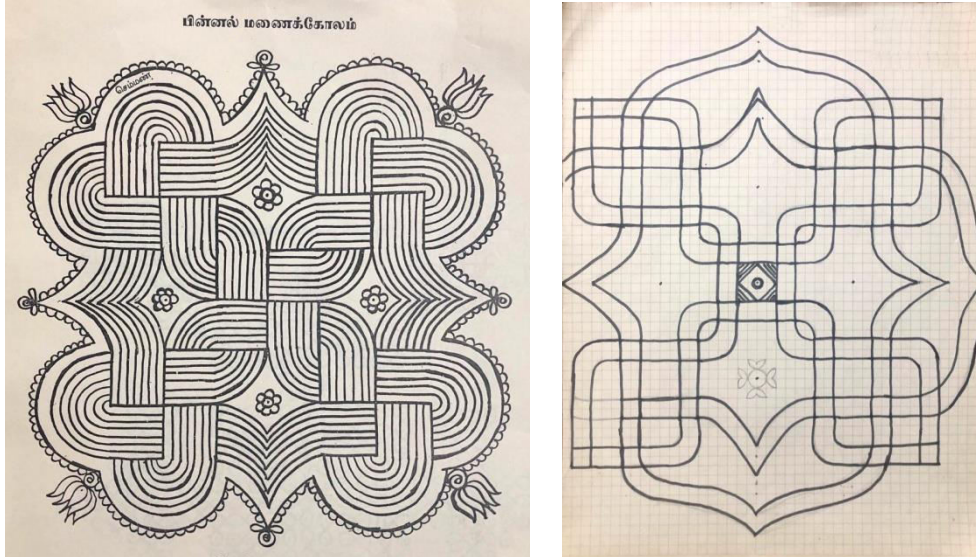
To create kolam above water, french chalk and color powders are used.

To create kolam under water, grease and color powders are used.

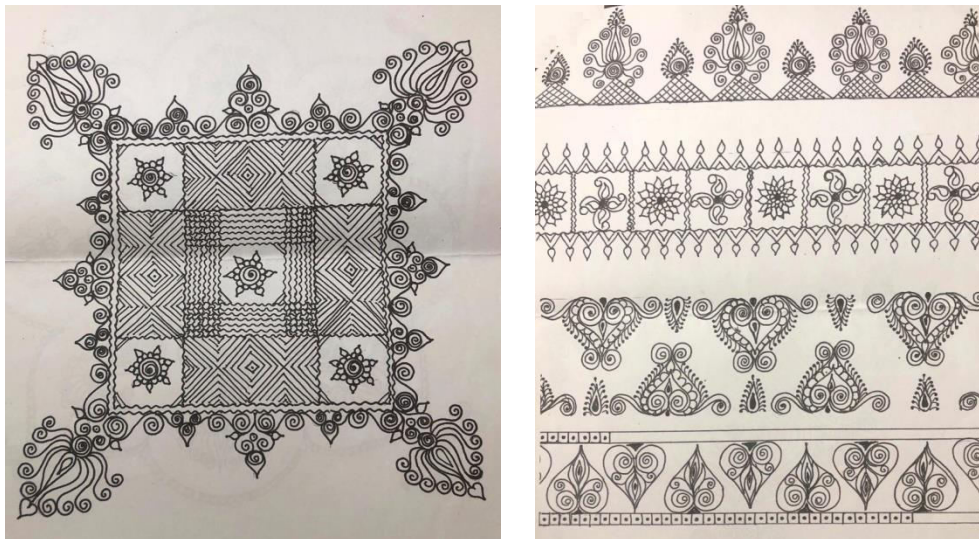
To create kolam in the middle of water, a round glass piece, grease and color powders are used.

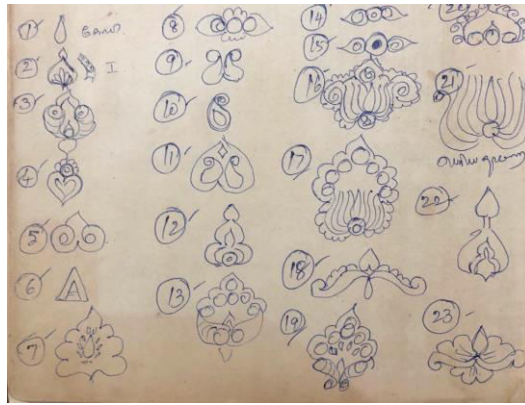
12. Manai kolam

Manai kolam is based on line kolam. In this, instead of one line, 4 to 8 parallel lines will be used. Usually these are drawn during weddings. These are drawn under the small wooden benches of height of about one or two inches, used by the bride and groom to sit on. The width of these kolams will be twice that of the height. A few examples are shown here. In one picture you can see only two parallel lines. While drawing it on the floor, more lines will be added.



To my knowledge, Mrs. Veni was the one who used to draw manai kolams with many beautiful added decorations. Some of the features she used to decorate are also shown here.

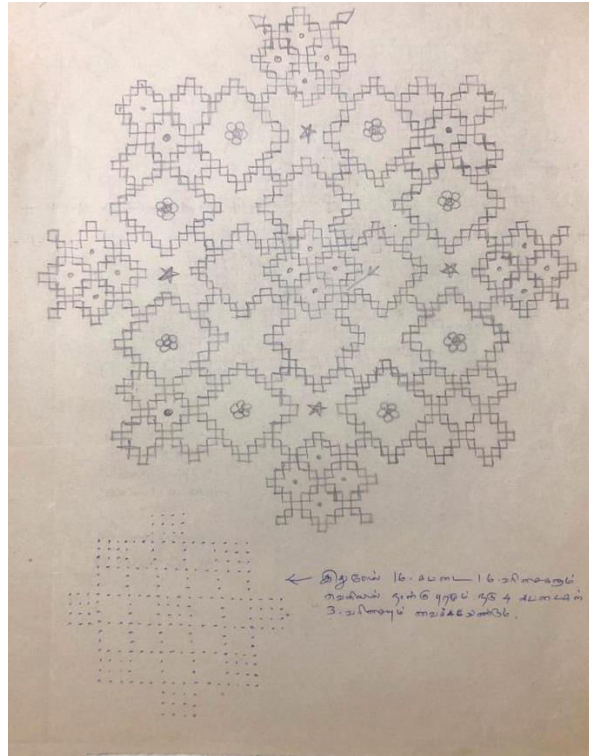




13. Katta kolam and achchu kolam

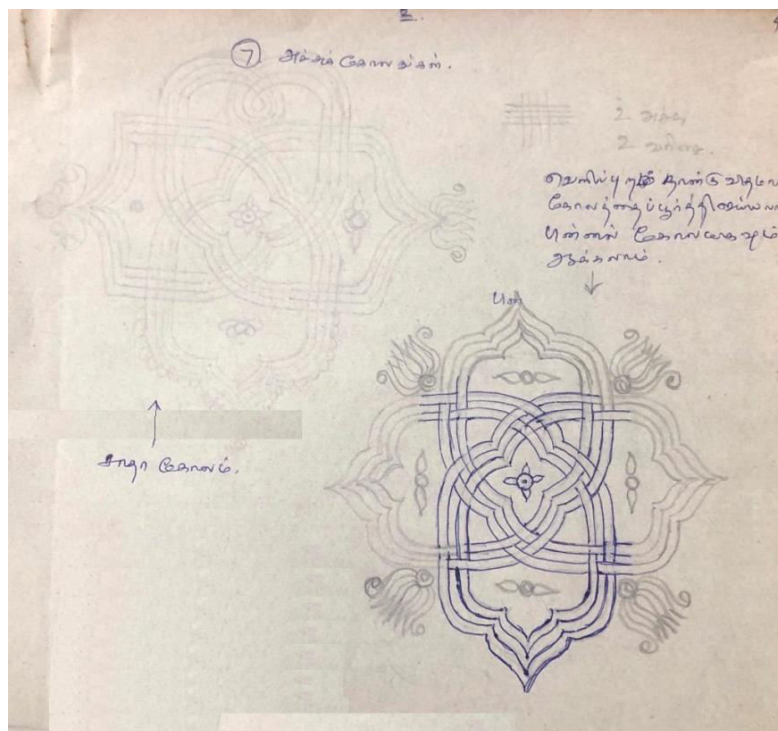
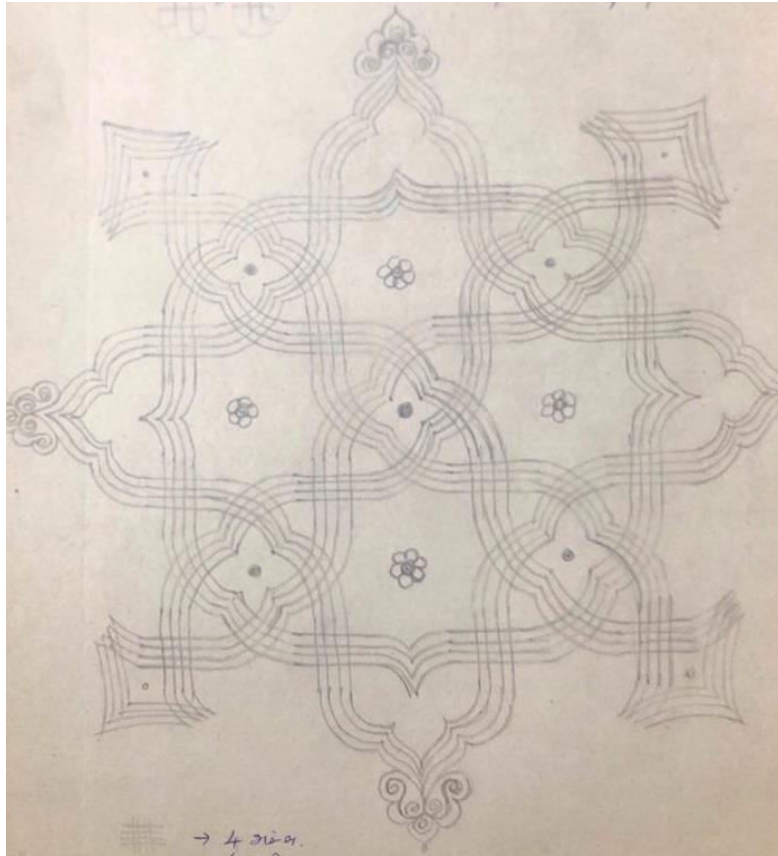
Katta kolam

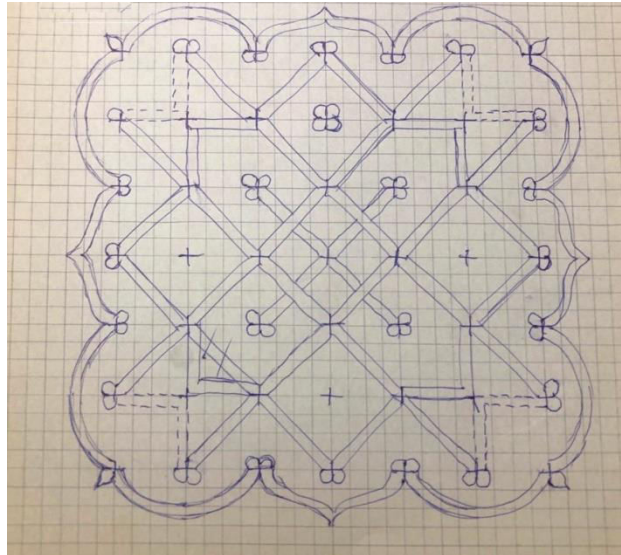
This name is because the kolam is made up of small squares. Kattam means square. First + signs are put in the places of dots. Then they are joined by a chain of small squares, in the shape of L. I learn about this kolam from an elderly women who was residing near our house. The number of dots and the way they are joined gives different kolams. When drawn on paper, the lines may be drawn as normal lines, to make it easier.



Achchu kolam

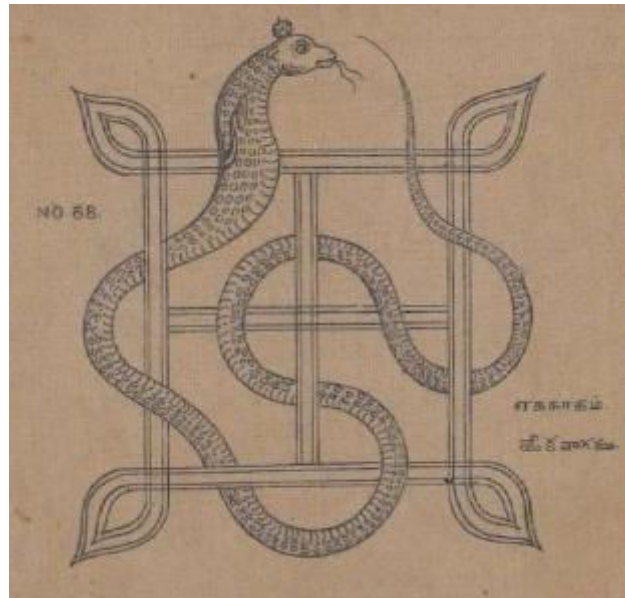
We can say that achchu kolam is a generalisation of katta kolam, or, katta kolam is a particular case of achchu kolam. Achchu means printing block. Here any picture is used instead of the + symbol. The joining can be any type of lines, instead of squares. When the lines cross, the kolam can be drawn as a normal kolam or can be made into a pinnal kolam. Pinnal means plait. That is, at the crossing of two lines, it is clearly shown which line is above, and which line is below. To draw pinnal kolam, one has to have utmost concentration. The above, below rendering should respect the symmetry also. This is tricky issue. You will know the difficulty involved only when you draw such a pinnal kolam. We shall see some examples here.



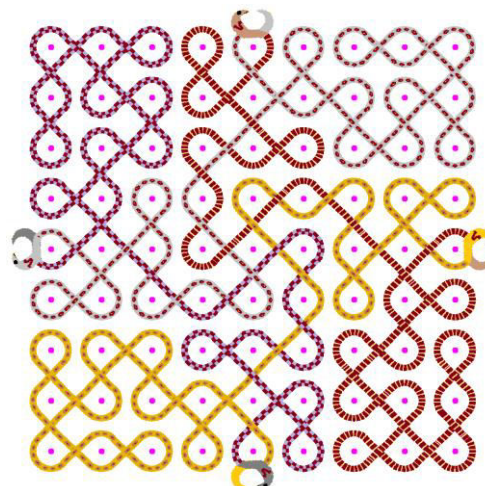
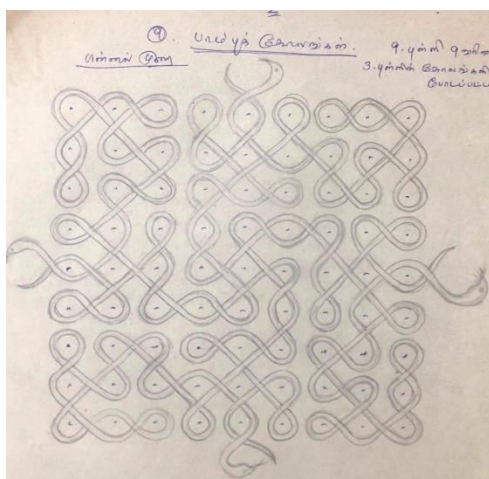


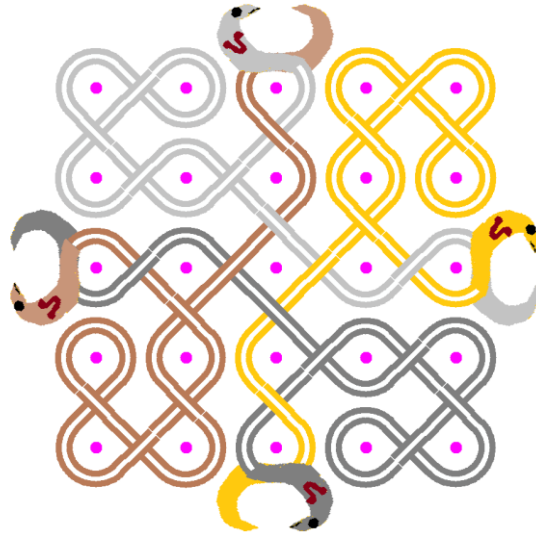
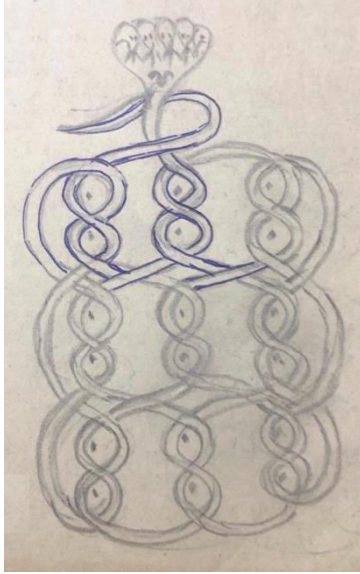
14. Snake kolam

Even though human beings are afraid of snakes, they have become a part of their life. This may be due to the fact that in villages, they depended on the snakes to control the rat population in the fields. This shows in kolams also. There can be one or more snakes in a kolam. On some special festival days snake kolams are drawn. Snake kolams are drawn as pinnal kolam, that is, the lines going one below the other are shown explicitly. This arrangement should respect the symmetry of the kolam. These are drawn using straight dots or circular dots.

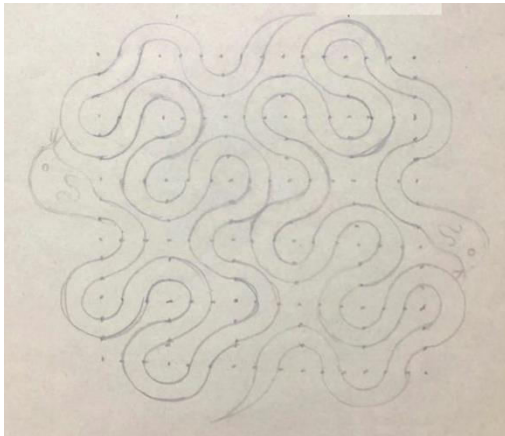


The above snake kolam is in the kolam book published in 1899, by Sriranga Naachchiyaarammal using her collection. No one can refuse if it is told that this kolam was drawn by a modern woman. This kolam with such an imagination is one of the kolams which has fascinated me. Many more modern looking kolams are also available in that book.

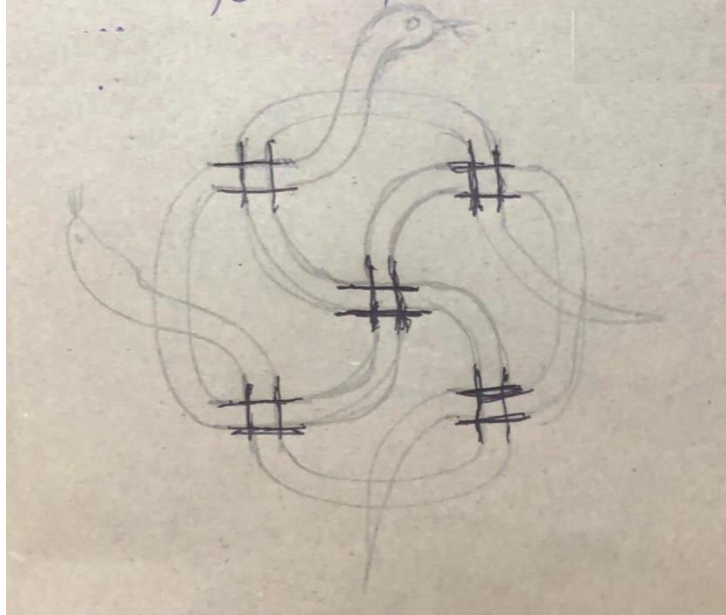




Snake kolams are drawn in 3 ways. In the first method, in the suzhi kolam, a line becomes thick and becomes the body of the snake. Head and tail are added at the end. To indicate which line comes below which line, a line can be drawn using two parallel lines. When the body crosses another one, the body should be alternately above and below the other part. This is considered as the specialty of the snake kolam. In our kolam software we have a facility to specify which line should come above in a crossing. Two snake kolams drawn using our software can be seen above.



In the second method, two adjacent lines form the body of the snake. The head and tail are created by combining the two lines.

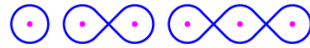


The third method is based on the achchu kolam. Here the achchu is like the # symbol. They are connected to form the body of the snake. The hash like dots are shown by thick lines.

15. Border kolam

In the border kolams the number of rows of dots can be anything like, one, two, three, etc. We shall see a basic method of creating border kolams. This is similar to Mr. Saavi Thamirasu's method of inner and outer joins for 5 by 5 kolams, which we have already seen. First we shall see how we use the inner joins. Then we shall look at outer joins. This is one method. Depending on the creativity of a person, border kolams can be generated in many different ways.

First we shall see border kolams with one row of dots.



We have to take the above 3 kolams with different inner joins, in some order and repeat it many times.

If the order is 1, 2, 2, a part of the kolam looks like the one shown below.

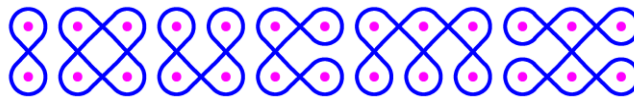


If we give the outer join as 0-1-2 above this kolam, and the outer join 1-1-3 below the kolam, what we get is shown below.



We have given outer joins on both sides. We can give only on one side also. We have used lotus and normal outer joins here. You can use only one of them, or a combination of them in a side.

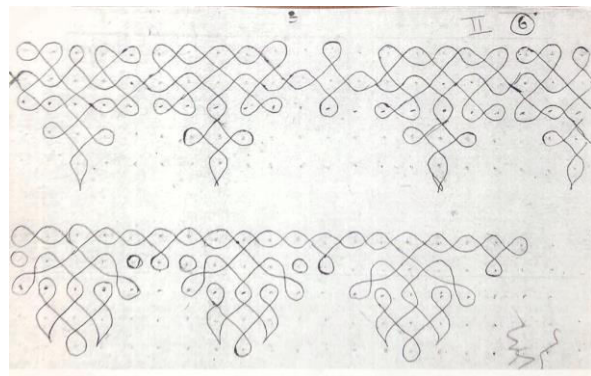
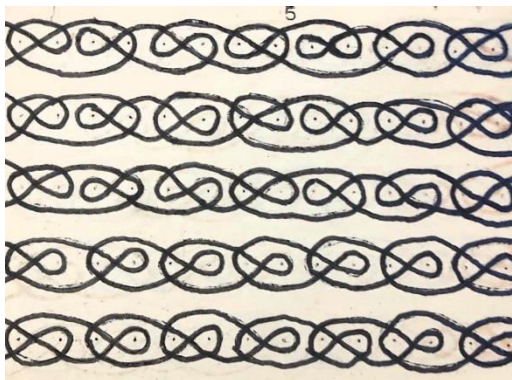
For the border kolams with two rows of dots, we have shown below some kolams with inner joins.

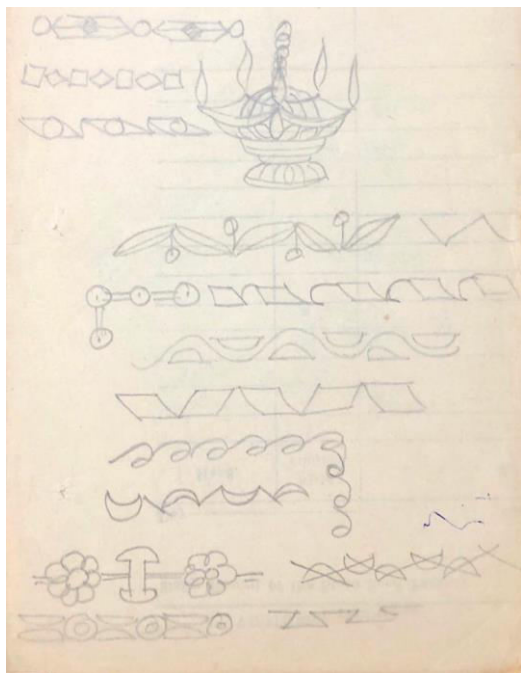
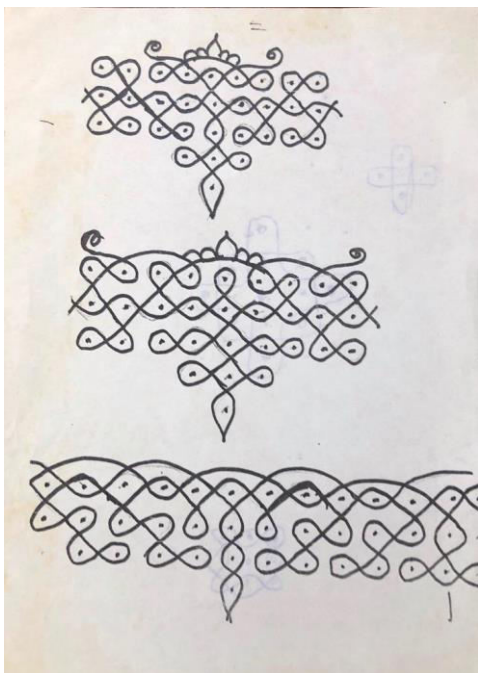
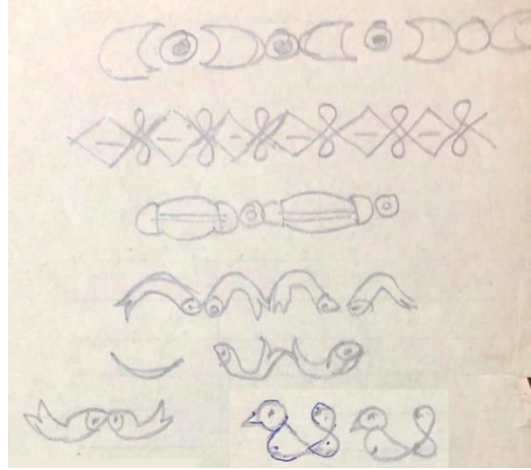
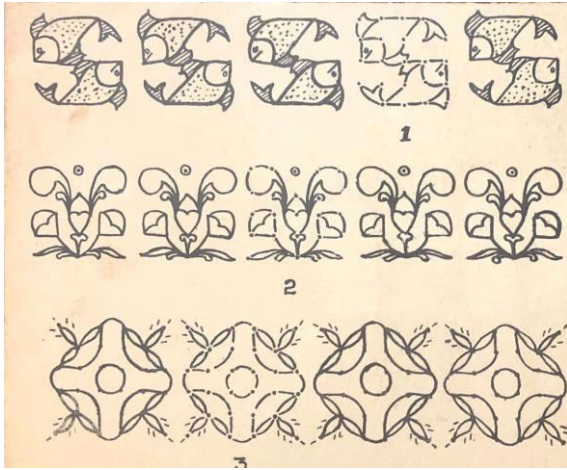


There are many such kolams. You have to repeat them as many times as you want. Add outer joins, above, or below, or in both places, as you wish, to get a variety of kolams.

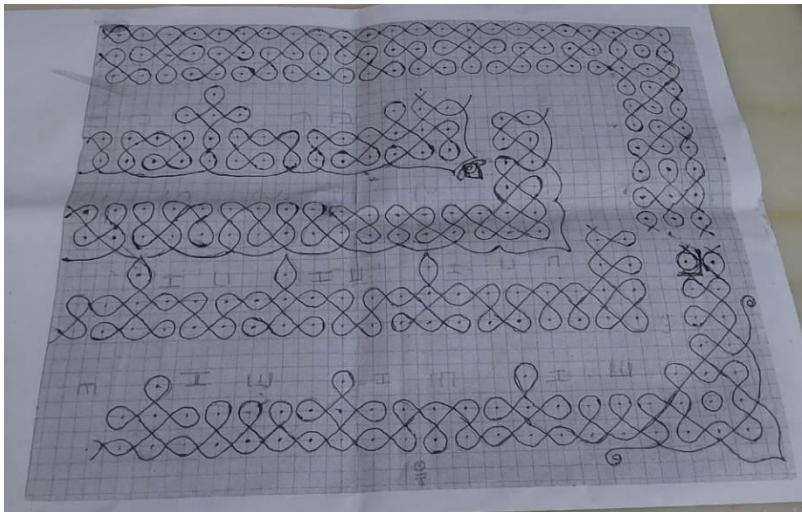
In the same way you can create border kolams with 3 rows of dots. Instead of outer joins, extra dots can be added, above or below or on both sides. Some border kolams are shown below.

In some border kolams you can see objects like fish, flower and lamp.





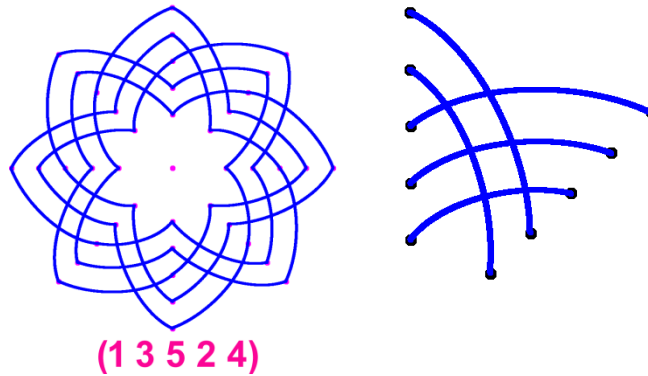
Before drawing the kolams on the floor, samples are drawn on the paper. You can see some of them below.



16. Idaya kamalam

The book 'Puthir, sindhanai, kanitham'(Puzzle, thinking, maths) which I (Krishnamoorthy) wrote was published in 1986. This was a popular introduction to graph theory, meant for common people. It received the Tamil nadu government's prize for scientific books. The line kolam is called graph in mathematics, and network in engineering. The mathematical subject dealing with graphs is called graph theory. We can call it as kola iyal in Tamil. Graphs representing the connecting lines used in computer chips and integrated circuits form kolams. They are functional and not beautiful. The connections between the cell phones is also a graph or kolam. The reason for the expansion in the study of graphs is due to its use in technology and computer science. I did my research in graph theory. There are a lot of interesting information and puzzles in this area. This book is a collection of such things, to arouse the interest of the school student. It is natural that puzzles interest the youngsters.

One of the chapters in this book is 'Idaya kamalam' meaning 'lotus of the heart'. This chapter deals with the topic of this kolam having exactly one line without ends. The mathematical concept of permutation is introduced and used here. It is in the form of a dialog between a brother and sister. a condensed and modified version is given below.



"Brother, Did you see the idaya kamalam kolam put in our pooja room? This has 40 dots. There are places in which two lines intersect. If we assume that they don't touch at these points, we can draw this kolam with just one line, without taking our hand from the floor. That is the divine property of this kolam. That is why it is put in the pooja room. This is what the aunty in the opposite house is telling. She says it is very rare to have such one line kolams. Do you know any other kolam like this?"

"You yourself can find out. Just tell me how to draw this kolam."

"You have put the dots in a radial fashion. There should be 8 radials, each with 5 dots. Let us count the dots from the centre to the outside. Then we have to join the dots from one radial to the next radial in the following method. First to third, second to fourth, third to fifth, fourth to first and fifth to second. That is all."

Shall we write this as 1->3, 2->4, 3->5, 4->1, 5->2?

"OK."

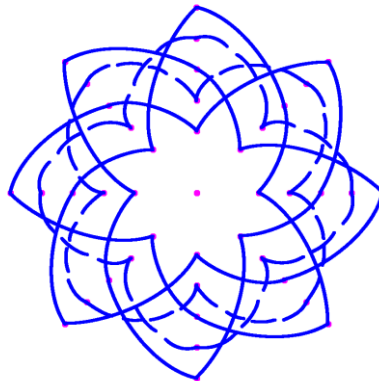
"We can write this as 1->3->5->2->4->1, and also as (13 5 2 4). In the second format, we go from the

$$\begin{pmatrix} 1 & 2 & 3 & 4 & 5 \\ 3 & 4 & 5 & 1 & 2 \end{pmatrix}$$

last number to the first number. We can write this as also. This is called a permutation. In the top row we write the numbers 1 to something in the ascending order. In the second row we write one of these numbers, here 5. Then in the next position, we have to write one of

the remaining 4 numbers. The next position is filled with anyone of the remaining numbers. Like that we fill all the positions. It is done with a total of $5 \times 4 \times 3 \times 2 \times 1 = 120$ ways.

We can write $1 \rightarrow 3 \rightarrow 4 \rightarrow 1$; $2 \rightarrow 4 \rightarrow 2$, as $(1\ 3\ 4)\ (2\ 5)$, and, $1 \rightarrow 5 \rightarrow 3 \rightarrow 1$; $2 \rightarrow 2$; $4 \rightarrow 4$, as $(1\ 5\ 3)\ (2)\ (4)$



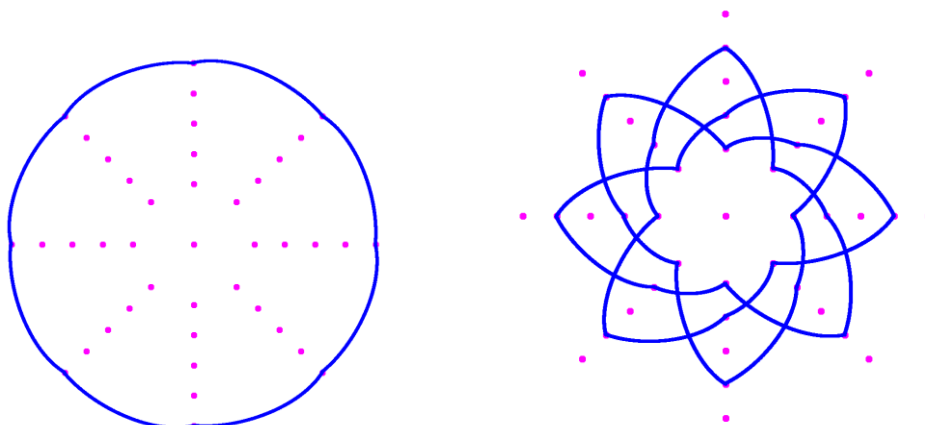
(1 5 3) (2 4)

Each one of these permutations give a kolam, using the 40 dots put as above. The question is which of these will give a single line kolam."

"Creating the 120 permutations, and drawing all these kolams... I can't do this." was Geetha's reaction.

"Who asked you to do that? It is not good method to solve this problem. It is called brute force method. It takes more time. Also the solution found will not be useful to problems of similar nature. What we need is a method which will be applicable to similar problems. We have to consider all such kolams, say, with m radials and each radial with n dots. We have to find which of them are made up of one line.

Before trying to solve a problem, to understand the nature of the problem, a few examples have to be studied. So let us first take the kolam with 8 radials and 5 dots in each of them. Whether the kolam defined by $(1\ 2\ 3\ 4)(5)$ will give a single line kolam?"



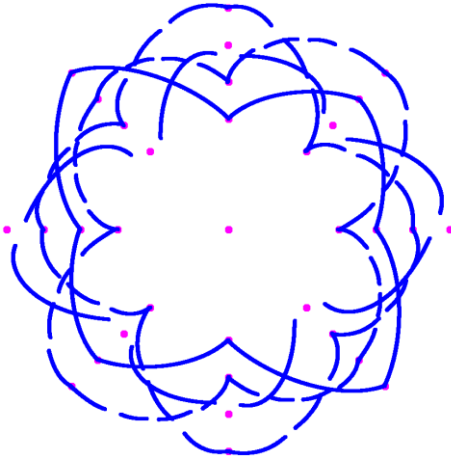
After thinking for some time, Geetha said "No. There is a separate line passing through all the fifth dots."

"(1 2 4) (3 5) ? "

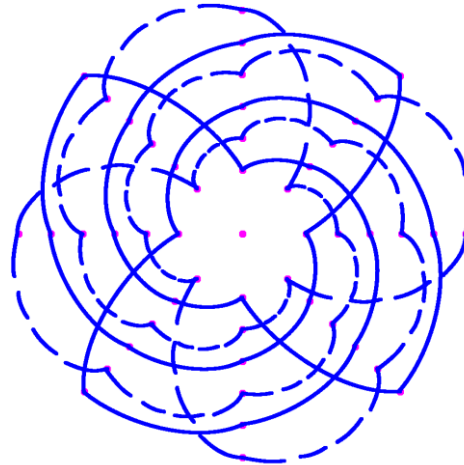
"If you start in any of the dots at a distance 1, 2, or 4, the line visits only the dots at these distances. It won't go to any dot at a distance 3 or 5. In the same way, if a line starts at a dot at distance 3 or 5, it can visit dots at these distances. Therefore, this kolam is not made up of one line." said Geetha.

"So?"

"To get a single line kolam, all the numbers should be within one set of brackets, like (1 2 3 4 5), (1 3 5 2 4), (1 5 2 4 3). That is the permutation should be written within one set of brackets only."



(1 3 2 4)



(1 2 3 4 5 6)

"OK. But, let us see whether this alone will give a single line kolam?. Let us consider a kolam with 8 radials and 4 dots per radial. Let us check (1 3 2 4). We find 4 lines in this kolam! Let us see another example. Consider 8 radials, 6 dots in a radial, and the permutation (1 2 3 4 5 6)."

The discussion goes like this. The method of representing the hour 13 in railway time table, as 1 in the clock, least common multiple and highest common denominator, are the mathematical concepts which come in. Then they decided that only if the number 1 is the only common denominator for m and n, single line kolam is possible. The discussion ends as follows.

"Now, tell me, Geetha. Can there be a single line idaya kamalam like kolam with 8 radials, each with 6 dots?"

"Not possible, since 2 divides both 8 and 6!"

"How about 8 radials and 5 dots per radial?"

"1 is the highest number which divides both 8 and 5. So, single line kolams exist. Permutations like (1 2 3 4 5), and (1 3 4 2 5) will give such kolams."

"That is right. How many such permutations are there?"

"You have to start with (1. In the next place any one of the n-1 integers has to be put. Then in the next place anyone of the n-2 integers have to be put. Like that we have to fill the permutation. This is done in $(n-1) \times (n-2) \times \dots \times 2 \times 1$ number of ways. If we take $m = 8$ and $n=5$, we have $4 \times 3 \times 2 \times 1 = 24$ ways."

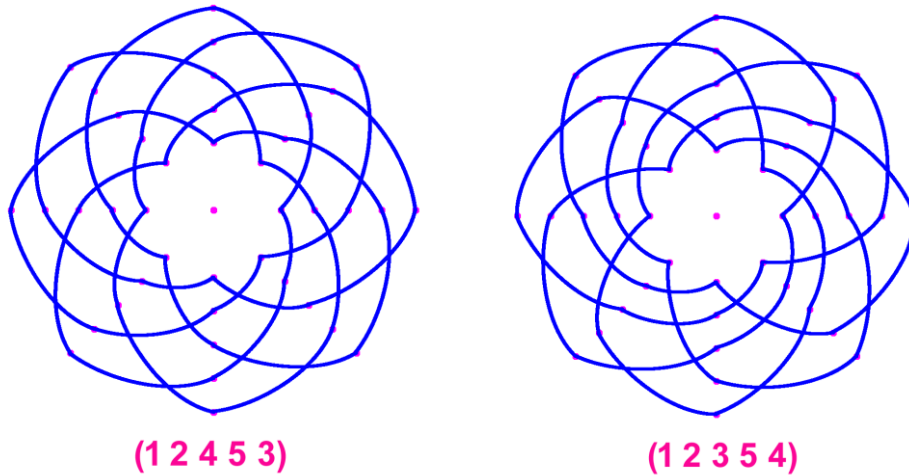
"Each one will give a single line kolam. Now tell me whether idaya kamalam is unique?"

"No. it is one among 24 such kolams."

"Draw some of them, and tell me whether you find any difference between them." Kumar concluded and left home.

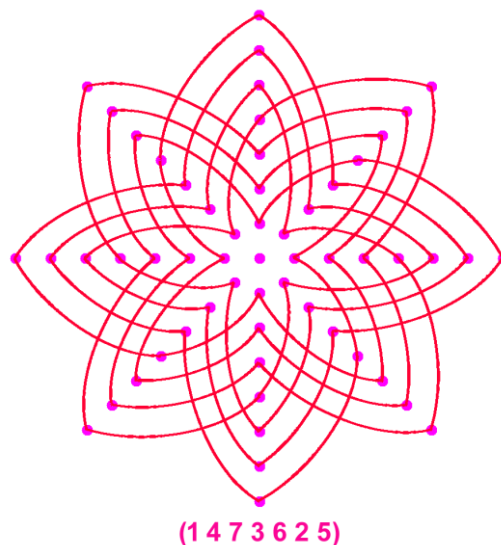
The next day the discussion continued.

"Brother, I found out three things. The kolams for (1 3 5 2 4) and (1 4 2 5 3) look similar. If one is going to the left side, the other one goes the right side. That is, one is the mirror image of the other. So, indeed there are only 12 kolams. Others are their mirror images.



Next, the (1 3 5 2 4) kolam which we call idaya kamalam is the most beautiful one. Of the others the kolams for (1 2 4 5 3) and (1 2 3 5 4) look good. Others are not beautiful.

The third finding is that for 8 radials, if we put 3, 5, 7, 9,... dots, that is any odd number of dots, we can get beautiful idaya kamalam like kolams.

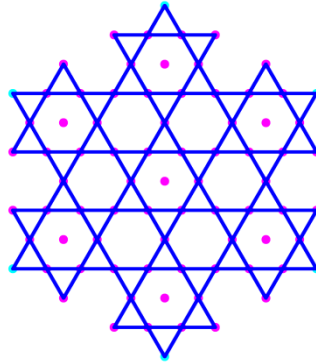


Permutations like (1 4 7 3 6 2 5) give single line kolams. So our idaya kamalam is just one of the endless sequence of kolams."

Kumar concluded "What you say is correct. But for me the kolam given by (1 2 4 5 3) looks prettiest, more than the idaya kamalam."

17. Some well known kolams

On all days or on Sundays only?



The above kolam is the one drawn everyday in the place where the pictures of Gods were hung in our house, first by my grandmother and then by my mother. This was done everyday. But, in the free supplement of March 1998, of Gokulam Kathir, in page 23, it is mentioned that this kolam is to be drawn only on Sundays only. I don't know why it was drawn every day in our house, or, why it is told that it should be drawn on Sundays. Many simply write anything they think about kolam, without any reason. But they will write in an authentic fashion as if they signed the government order, and as a conclusively proved fact. This one is an example.

magic square or kolam?

This is an interesting thing we got when searched the internet for kubera kolam.

N

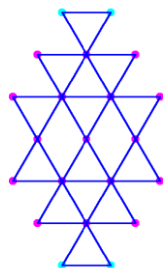
27 20 25

22 24 26

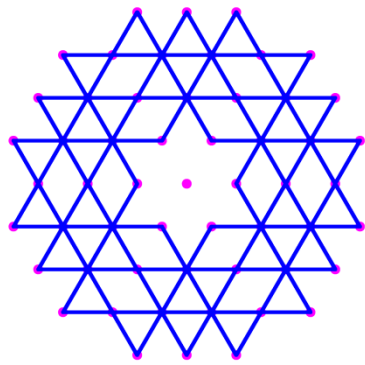
23 28 21

S

This magic square is called Kubera kolam! They specify the direction in which this kolam has to be drawn. How this can be called a kolam, I don't know. Some line kolams are also called kubera kolam . All these do not look the same strictly. There are variations in drawing. The first one below is drawn using our software. In the second, the dots are not aligned properly. Lines have not changed. In the third both dots and lines are not aligned properly.

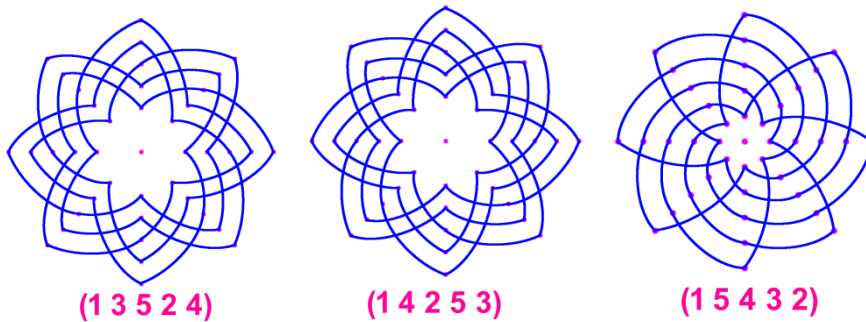


Iswarya kolam



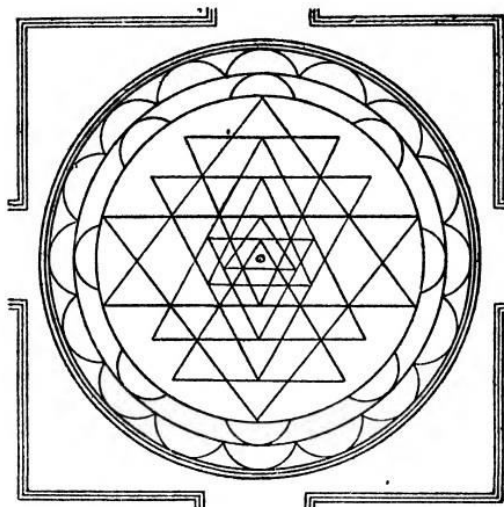
This kolam has not stopped with drawing with kolam powder. It is created on cardboard using plain glass and mirror pieces, as a wall hanging for the pooja room.

Idaya kamalam



We have already seen idaya kamalam kolam. Using that notation, the kolam got for the joining (1 3 5 2 4), is called idaya kamalam. The kolam got for the joining (1 4 2 5 3) is called vidya sarswathi. The kolam got for the joining (1 5 4 3 2) is called the durga kolam (Mangayar malar October 1998 annexure).

Srichakra



Srisankara bhagavath paatha has written a book called Sowndarya lahari (THE OCEAN OF BEAUTY). A book with its commentary was written in 1937 by Pandit Subramaniya sastry and Mr. Srinivasa iyengar. They say that to understand the meaning of some verses it is necessary to know the construction of the Srichakra kolam. They have given two methods of drawing the kolam. They say that when chanting the verses 22 and 31, for 45 days, each day a thousand times, this kolam has to be etched on a gold plate and worn as talisman. The methods of drawing the kolam has been reproduced below.

The following construction is given by Kaivalyasrama, a commentator of this work, for the building of the Cakra.

Describe a circle, with an imaginary vertical line of a suitable length as its diameter. Divide the diameter into forty-eight equal parts and mark off the sixth, twelfth, seventeenth, twentieth, twenty-third, twenty seventh, thirtieth, thirty-sixth and forty-second divisions from the top. Draw nine chords, at right angles to the diameter, through the nine points marked off, and number them accordingly. Rub off $\frac{1}{16}$ th part of No. 1, $\frac{5}{48}$ ths of No. 2, $\frac{1}{3}$ rd of No. 4, $\frac{3}{8}$ ths of No. 5, $\frac{1}{3}$ rd of No. 6, $\frac{1}{12}$ th of No. 8, and $\frac{1}{16}$ th of No. 9, at both ends of each. ¹ Draw triangles with lines, Nos. 1, 2, 4, 5, 6, 8 and 9 as bases and the middle points of Nos. 6, 9, 8, 7, 2, 1 and 3 respectively as their apexes. Draw also the two triangles with Nos. 3 and 7 as their bases and the lower and the upper extremities of the diameter as apexes respectively.

Thus we get forty-three triangles pointing outwards, composed of one in the middle, eight triangles around it, two sets of ten triangles around the eight triangles, one set about the other, and fourteen triangles around them. Then, by marking off eight points in the circumference equidistant from one another, commencing from the upper extremity of the diameter and constructing one petal, over each of them, is formed the eight-petalled lotus. Then, circumscribe a circle touching the outer extremity of the petals. Divide the circumference of the circle so described into sixteen equal divisions and draw symmetrically sixteen petals over them, as before. Then, circumscribe a circle round the sixteen petalled lotus, as before, and enclose the second circle so described in two concentric circles at equal distances from each other. Construct three squares about the outermost circle, with sides equidistant from each other, the inner-most square not to touch the outermost circle. Marking off four doorways on the four sides, each equidistant from either extremities, rub off the interspaces. The figure thus formed is the Sri-cakra, The centre of the circle is known as the Bindu.

¹ In the construction of the Sri-cakra adopted by some worshippers, in actual practice, $\frac{1}{12}$ th of the chord No. 2 is rubbed off on either side, instead of $\frac{5}{48}$ ths, as given by Kaivalyasrama. Further, adopting $\frac{1}{48}$ th of the vertical diameter of the inmost circle as the unit, the positions of the several terms of the Sri-cakra are also fixed as under : The height of the entire Sri-cakra is ninety-six units, of which forty-eight are taken up by the inmost circle, leaving twenty-four units at the top and twenty four at the bottom. The eight-petalled and sixteen petalled lotuses will touch the circles cutting the vertical diameter produced both ways, at the eleventh and twentieth unit-distances from the upper and lower

extremities of the diameter. Of the four remaining units, the three concentric circles lying beyond the sixteen-petalled lotus will take up one unit. The three units yet remaining will mark the extremities of the three quadrangles forming the outermost boundary of the Sri-cakra. By marking off forty-three units from either extremity of the outermost quadrangle, the intervening space of ten units should be rubbed off on the four sides of the three quadrangles forming the Bhu-grha. This will give the four gateways of the Cakra.

The Sri-cakra of the Samhara-krama of Laksmi-dhara can be obtained by turning the cakra recognized by the Vamakesvara-tantra upside down. This is given as the diagram relating to the twenty-second stanza. The Sri-cakra of the Srsti-krama is given as the diagram relating to the thirty-first stanza.

The mode of constructing the Sri-cakra, in the Kristi-karma, of the Samayin-s, according to him, is as follows : Draw an isosceles triangle with its apex pointing upwards and its base parallel to the bottom line of the sheet. Place the Bindu, a dot, a little above the base, in an imaginary vertical line bisecting the base. A little above the Bindu, draw a straight line parallel to the base, intersecting the sides of the original triangle. Draw an isosceles triangle with apex pointing upwards over this line. Draw a straight line through the apex of the first triangle, parallel to its base and construct an isosceles triangle on it, with apex pointing downwards, so that its sides may pass through the points of intersection of the base of the second triangle with the sides of the first triangle. These two points, where three straight lines intersect each other, are technically styled Marman-s, to distinguish them from the points of intersection of two straight lines, which are known as Samdhi-s. Thus, then, are formed the eight corner-triangles pointing outwards, which together are known as the Asta-kona-cakra, By producing the topmost and the bottom-most of the three horizontal lines both-ways and constructing two isosceles triangles, one of them with apex down and the other with apex up, so that the sides of the former may pass through the extremities of the bases of the two triangles pointing upwards and the sides of the latter triangle may pass through the extremities of the base of the original triangle pointing downwards. By producing the sides downwards, of the inner triangle with apex up and drawing a straight line parallel to the base, through the apex of the triangle pointing downwards, a new triangle is formed. Similarly, by producing the sides upwards, of the triangle with apex down and drawing a straight line parallel to the base, through the apex of the first outer triangle with apex up, another triangle is formed. At this stage are obtained ten corner-triangles pointing outwards, which together form what is known as the Antardasara, the inner ten-spoked Cakra. Similarly, by producing the horizontal bases, drawing the arms of triangles at corner-points, so as to form Marman-s and drawing straight lines parallel to the bases, through the apexes of triangles pointing up and down, the ten corner triangles pointing outwards and known as the Bahirdasara or the outer ten-spoked Cakra, is formed. Again, by producing both-ways the bases at the top and the bottom of the Antar-dasara and constructing isosceles triangles with apex down and apex up; and again by producing the sides of triangles whereby Marman-s could be formed and drawing straight lines parallel to the bases, passing through the apexes of the freshly constructed triangles, the fourteen corner triangles pointing

outwards known as the Catur-dasara the fourteen-spoked Cakra, will be obtained. Thus, we get, in all, forty-three corner-triangles, including the inmost one, twenty-four Samdhi-s and eighteen Marman-s. It may, however, be noted here, that Laksmi-dhara commits an error in giving the number of Marman-s as twenty-four and, quoting the Candra-jnana-vidya in this connection, seeks to reconcile the figure twenty-eight given therein, as of the Marman-s, by pointing out that the eight-petalled lotus, the sixteen-petalled lotus, the three outermost circles and the three quadrangles may be treated as four Marman-s, which, together with his twenty-four, would go to make up the twenty-eight Marman-s of the Candra-jnana-vidya. This is apparently a laboured explanation, which, in trying to hide one fault, only results in making it two. A more ingenious attempt at reconciliation would have been, for him, to treat the six points of contact of the Catur-dasara with the inmost circle also as Marman-s.

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