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Rhythm, Taala and combinatorial structures

-Ananth M Athreya
Department of AIML
RV College of Engineering

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INTRODUCTION

- Taala/rhythm is a very essential element in music.
- Taala is a Chandobaddha kriya/ an action/phenomenon that has Chandas.
- In Carnatic Music, the percussion instruments/Talavadyas are Mridangam, Khanjira, Morsing, Ghatam, Thavil.

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INTRODUCTION

Mridangam

Khanjira

Morching

Ghatam

Thavil

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SOME IMPORTANT TERMS

- **Akshara**: Beat
- **Mathra:** Subdivision of an akshara, determined by nade/gathi
- **Avarthana**: Full cycle of the thala

Elements of a thala

There are 3 elements of a thala.

Element	Measure	Hand representation	Representation on paper
Laghu	Variable measure(3,4,5,7,9)	Tap with palm down and count fingers	|
Dhrutha	2	Tap with palm down and tap with palm up	0
Anudhrutha	1	Tap with palm down	U

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SOME IMPORTANT TERMS

Types of Thalas

Thala	Representation on paper
Dhruva	|0||
Mathya	|0|
Roopaka	0|
Triputa	|00
Jhampe	|U0
Atta	||00
Eka	|

Types of Laghus/Jathis

Laghu	Measure
Thrishra	3
Chaturashra	4
Khanda	5
Mishra	7
Sankeerna	9

- While naming the thalas, we use the term Jathi and not Laghu.
- With the given types of thalas and laghus, the number of thalas=5X7=35

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SOME IMPORTANT TERMS

Some popular thalas

- **Aadi**-Chaturashrajathi Triputathala
- **Roopaka**-Chaturashrajathi Roopakathala(In compositions, roopakathala is just tap 2 twice with palm down, and tap once with palm up.
- **Atta**-Khandajathi Attathala(Used in Attathala Varnas)
- **Chaaputhalas**- These are the thalas that do not have Laghu DHrutha or Anudhrutha. It's just tapping with palm down. Types of chaaputhalas are:
  - **Khandachaapu**- Chaturashra nade contains 10 aksharas
  - **Mishrachaapu**- Chaturashra nade contains 14 aksharas
  - **Sankeernachaapu**- Chaturashra nade contains 18 aksharas

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SOME IMPORTANT TERMS

Nade(Nadai)

Nade determines the number of mathras per akshara

Different types of nades

Laghu	Measure
Thrishra	6
Chaturashra	4
Khanda	5
Mishra	7
Sankeerna	9

The default nade of any Thala is chaturashranade.

KORVAIS

- Korvai is a structure that contains 2 parts.
  1. Poorvanga or the first part: This is a combination of phrases like Dhi,;Thankita Dhiguthakatharikita, or gaps or Kaarvais (Eg. Dhin having unit measure 2, Dhinku having unit measure 3, etc.)
  2. Uttaranga or the latter part: This is a combination of Thadiginathom phrases and Kaarvais

- Korvais are played by percussion instruments in 2 instances.
  a. At the end of every round(Optional)
  b. At the end of the Thani, after the Mohara(Compulsory) Eg. https://youtu.be/NqdclyYkxr8?si=0MFA7ilUpmDk81eK&t=1132

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KORVAIS

- **Example of a Korvai**

(Dhi,; Thankita Dhiguthakatharikita Dhin, Tha, Dhin,;) × 3
Thadiginathom (Dhinku) × 3
(Thadiginathom) × 2 (Dhinku) × 3
(Thadiginathom) × 3

Notations used

Notation	Purpose
Tharikita	The phrase is in next speed
,	1 beat
;	2 beat

KORVAIS

- By keeping the total number of mathras constant, we can create new Korvais in 2 ways.
  - By changing only the Uttaranga
  - By changing both the Poorvanga and Uttaranga

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CHANGING ONLY THE UTTARANGA

Consider a Korvai

(Dhi,; Thankita Dhiguthakatharikita Dhin, Tha, Dhin;) × 3
Thadiginathom (Dhinku) × 3
(Thadiginathom) × 2 (Dhinku) × 3
(Thadiginathom) × 3

Here,

- Dhi,;Thankita Dhiguthakatharikita is 8 beats
- The Kaarvai Dhin, Tha, Dhin; is 8 beats
- Thadiginathom is 5 beats
- The Kaarvai Dhinku is 3 beats
- The total count of Poorvanga is 16 × 3 = 48
- The total count of Uttaranga is 5 + 9 + (5 × 2) + 9 + (5 × 3) = 48
- The total count of the Korvai is 48 + 48 = 96, which is 3 Aavarthanas/cycles of AadiThala(1 Aavarthana of AadiThala = 32 beats)

CHANGING ONLY THE UTTARANGA

To create a new Korvai, we need to remove 3 beats from each Kaarvai in the Uttaranga. The total number deleted is 3 × 2 = 6. This 6 beats should be added to each Thadiginathom to make Thadhin,Ginathom(6 beats). Hence, the new Korvai is:

(Dhi,; Thankita Dhiguthakatharikita Dhin, T ha, Dhin;) × 3
Thadhin, ginathom (Dhinku) × 2
(Thadhin, ginathom) × 2 (Dhinku) × 2
(Thadhin, ginathom) × 3

Here, the total count of the Korvai remains the same.

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CHANGING ONLY THE UTTARANGA

Further, we can remove 3 beats from each Kaarvai in the Uttaranga. The total number deleted is 3×2 = 6. This 6 beats should be added to each Thadhin,ginathom to make Tha,dhin,Ginathom(7 beats)
Hence, the new Korvai is:

(Dhi,; Thankita Dhiguthakatharikita Dhin, Tha, Dhin;) × 3
Tha, dhin, ginathom Dhinku
(Tha, dhin, ginathom) × 2 Dhinku
(Tha, dhin, ginathom) × 3

As the earlier case, the total count of the Korvai remains the same.
In this way, we can create new Korvais by making changes in the Uttaranga only.

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CHANGING BOTH POORVANGA AND UTTARANGA

Consider a Korvai

(Dhi,; Thankita Dhiguthakatharikita Dhin, Tha, Dhin,) × 3
Thadhin, ginathom Dhin,
Thadhin, ginathom Dhin,
Thadhin, ginathom

Here,

- Dhi,;Thankita Dhiguthakatharikita is 8 beats
- The Kaarvai Dhin, Tha, Dhin, is 6 beats
- Thadhin,ginathom is 6 beats
- The Kaarvai Dhin is 2 beats
- The total count of Poorvanga is 14 × 3 = 42
- The total count of Uttaranga is 6 + 2 + 6 + 2 + 6 = 22
- The total count of the Korvai is 42 + 22 = 64, which is 2 Aavarthanas/cycles of AadiThala(1 Aavarthana of AadiThala = 32 beats)

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CHANGING BOTH POORVANGA AND UTTARANGA

Now, we have to create a new Korvai. Remove 2 beats from each Kaarvai in the Poorvanga. Total beats removed is 2 × 3 = 6. Divide 6 by 3, which is 2. Add 2 beats to each Thadiginathom in the Uttaranga, resulting in Tha,Thadhin,ginathom(8 beats). The new Korvai created is

(Dhi,; Thankita Dhiguthakatharikita Dhin,;) × 3
Tha, Thadhin, ginathom Dhin,
Tha, Thadhin, ginathom Dhin,
Tha, Thadhin, ginathom

Here,

- The Kaarvai Dhin,; is 4 beats
- The total count of Poorvanga is 12 × 3 = 36
- The total count of Uttaranga is 8 + 2 + 8 + 2 + 8 = 28
- The total count of the Korvai is 36 + 28 = 64
- The total count of the Korvai remains the same.

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CHANGING BOTH POORVANGA AND UTTARANGA

To create a new Korvai, remove 2 beats from each Kaarvai in the Poorvanga.Total beats removed is 2×3 = 6. Divide 6 by 3, which is 2. Add 2 beats to each Thadiginathom in the Uttaranga, resulting in Tha,Dhi,Thadhin,ginathom(10 beats). The new Korvai created is

(Dhi,; Thankita Dhiguthakatharikita Dhin,) × 3
Tha, Dhi, Thadhin, ginathom Dhin,
Tha, Dhi, Thadhin, ginathom Dhin,
Tha, Dhi, Thadhin, ginathom

Here,

- The total count of Poorvanga is 10 × 3 = 30
- The total count of Uttaranga is 10 + 2 + 10 + 2 + 10 = 34
- The total count of the Korvai is 30 + 24 = 64
- The total count of the Korvai remains the same.

ALGORITHMIC COMPOSITION OF RHYTHMIC VERSES

In this section, we will see the composition of Korvais in 2 cases.

- Samam-The start of the avarthana
- Edapu-Line of the composition starting before or after the start of the avarthana

Example of Samam: https://youtu.be/6AyEFYjv4W0?si=TiLEJuB1UQhlwEPf
Example of Edapu: https://youtu.be/ewX_VxXfo60?si=q28-dYzqdUAvt-sD

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COMPOSITION OF KORVAIS IN SAMAM

Problem statement: Given a Thala(n Matras) and phrase(Sollukattu/Haas), create a Korvai

Algorithm:

1. Create the Poorvanga with the combination of phrase and Kaarvais
2. Calculate the total count of the poorvangam(T(P))
3. Add the Uttarangam such that the total count is a multiple of n. So,
    - M(P)=T(P) mod n
    - Add kn to n-M(P)(k is any integer) to get T(U)
    - For that T(U), create the Uttaranga

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COMPOSITION OF KORVAIS IN EDAPU

Problem statement: Given a Thala(n mathras) and k mathra Edapu, find the total count of korvai.
Constraints: n is not a multiple of 3.
Algorithm:

- Find out that m such that mn+k is a multiple of 3.
- Divide mn+k by 3 to get the total count of the korvai.

THANK YOU