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An user friendly Scheme of Numerical Representation for Music Chords

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Abstract

The standard western music notation for the major and minor chords is available in the world. But the understanding of major and minor chords is very difficult for learning peoples particularly children's. It is very complicated to memory of all major and minor chords and also roots of all chords. This invention is easily understand by children and easily captured in standard piano and other instruments. The new method of conveying chords by numerical techniques is used in this invention. The octave notes are derived in to two different heads of major and minor chords by numerical method. There are two main equations are implemented and it is very easy to understanding of all major and minor chords.

1. Introduction

Music notations are the sequence of notes documents report for musicians. A lot of music notation format have been created with various presentations such as letter, standard notation on musical staves, bar-based MIDI notation, graphic notation, tablature and mannered notations. The standard five lines music staves notation is commonly using for worldwide musicians. Generally the piano has seven set of octaves and electronic keyboard has 5 set of octaves are using for regular music performances. Similarly, the lead guitar has three to four octaves using for the music performance. The bass guitar is one of the important instruments for music performance and it has 2 octaves. The king and queen instruments namely trumpet and violin has three and four octaves respectively. The wind instrument of flute has three octaves are using for normal performance.

It is clear that all instruments having minimum two octaves and maximum seven octaves. It is necessary to identify the note in which octave and simple method to play all types of major and minor chords. The musical staves and tablature bar notations are very complicated to understand and it is very hard to memory of this concept. In this work, the numerical expressions have implemented of all types chords and it is very easy to understand the concept with any confluences.

2. Literature Review

The various researchers are discussed with variety of music notations for the simple format. All the researchers analyzed with different dimensions of music notations. In this chapter, some of important research papers and patents are discussed about the various methods of notes preparation (Kuo and Chuang) investigated the western notation with different colors of symbols for easy understanding. It is very useful for the beginners and children's. The entire clefs are denoted by different pet animals face and different colors. The first of C is indicated small circle with red color. Similarly other notes are indentified different colors with circle and triangle symbols. (Kim and Song) analyzed various types of music learners and produced comparison result of learners populations. The feed about various music styles like jazz, pop, rock etc were found and compared. It is clearly identified the attitude of the music teacher and interesting about the learners. The understandings about the learners are clearly discussed by various teachers' feedback. (Shor) discussed about the western notes and symbols are created activity based lessons for young children's. The various count clef symbols are made by geometrical model and placed respective notation lines. It is the new type of activity music lessons for young children. It is very good creativity for the children at the age of 3 to 5. (W Hall) analyzed the sound frequency of various notes and calculated the wave length. The mathematical equations are generated by the sine wave length of each and every music notes. The equations are developed by the implementation of time simulation of all music notes. The time interval and notes are compared and analyzed the different equations. The frequency ranges from 440Hz to 1760Hz are used for this investigation.

(Srinivasamurthy, Holzapfel, and Serra) investigated the different methods in computational rhythm report of Carnatic and Hindustani music of India, and Makam music of Turkey. The style and methods of various music like carnatic, Hindustani, makam and Turkish. The new algorithm were created for various style of music and analyzed the each and every cycle of length of time intervals. It is clearly concluded the various style, time and intervals of music notes and indentified various length of frequency in each notes. It is very useful for playing with different time interval of all notes and also understood about different types music collections.

(Taub and Cabanilla) US 8,471,135 B2 invented the music transcription of auto transfer signal system. The audio input signal is converted in to music score represent data. In this invention, the audio frequency is amplitude the information based on the scale frequency and it is divided in to various parts like note durations, rest, pitch and tempo of the music. Finally the completed data is generated in the music representation score sheet. The patent no US 2005/0076771 A1 analyzed the methods of conveying the musical information. This invention is very simple method to understanding the concept of scale and roots. The piano keys are denoted by two names such as whole note and semi note. This invention is simple to storing and conveying the written format and easy to printout. The roots are denoted by the representation of whole note and semi note of all major and minor chords. (Little, Woodside, and Manjarrez) , invented the musical systems and methods for changing the tones and pitch etc. This invention is to create various frequencies of natural and artificial sounds. In this invention, the electronic device is introduced with different tones. Virtual musical instruments (VMI) on a touch sensitive graphical user interface (GUI) are implemented in this invention. It is clearly disclosed with various computer codes and programs are claimed.

(Sturm et al.) analyzed the research that applies machine learning to music modeling and generation proposes model architectures, datasets and training methods, and gauges system performance with the usage of quantitative measures like sequence or qualitative listening tests. It is usefulness on the real-world practitioners, outcomes obtained in order to inform the development and application of the machine learning. This article attempts to accomplish these targets for machine learning applied to the creation of music. Along with the practitioners, several applications of machine learning for the creation of music are developed and it can be used for presentation in public concerts. The entire experience of arriving at several methods of advancing such applications of machine learning to the creation of music is reflected.

(Solomon) analyzed the first time in history, the fact that any combinations of tones may give rise to legitimate harmonic building block for compositions is recognized. A number of these chords do not have a specific name, that is, they do not have titles like minor or major. Chords that lack standardized names have been described without any means of correlation with other analyses throughout the analytic literature. For scholarly writing or conversation, the non tertian chords do not have any commonly used titles. A collection of tables and methods have been constructed in order to confront the requirement of tools to describe and to relate untraditional chords. A list of all the possible combinations of twelve equal-tempered pitches has been created and specific names are given. Among the sets of equal cardinality, an easy way to find the relationships has been provided in addition.

(Pauwels and Martens) Investigated a probabilistic framework for simultaneous estimation of the chords and the keys from the audio are presented. The framework is formulated in terms of acoustic models for both the chords and the keys, and a model which was proposed earlier that contains musicological knowledge about the keys and the chords. A compound of four components is being consisted by the latter: duration and change of model for both the chords and the keys. The modification of each components separately and choosing the appropriate source of knowledge for each is allowed in this division. Furthermore, the interpretation of roles and their relevance in estimation procedure becomes easier. The system's multiple configurations were compared, increasing their complexity. This paved way for exploring the relations between the chords and the keys, and the importance of integrating the musicological knowledge gained earlier into an automatic estimation system. It was also found that the scores of chord estimation are mostly dependent on the integration of durational knowledge, while the estimation of keys also requires prior information about the broader context.

(Manjabhat et al.) discussed about in order to identify raga and the tonic of a bit of a given carnatic music. The method proposed is split up into two phases. In the initial phase, using the features that are extracted from the pitch histogram, the raga and the tonic have been independently determined. In the next phase, using the derived note information, the tonic and the raga are updated iteratively. In this work, based on the properties extracted from the probability density function (pdf) of pitch values that are extracted from the piece of music the raga will be recognized. With the usage of different classifiers like decision trees, Gaussian mixture models and feed forward neural network model, the raga identification is done. For tonic identification, a mathematical model which is based on the parameters of pitch pdf is proposed. The proposed identification systems for raga and tonic are evaluated based on two datasets: 213 pieces of music from 14 ragas and Comp Music Dataset (538 clips from 17 ragas). For the first data-set, the average accuracy of tonic identification was found to be 94.83% and the average accuracy of raga was found to be 90.14%. With the Comp Music Dataset, for raga identification, 95% average accuracy is achieved.

(Koduri et al.) Intonation is one of the fundamental music concepts that hold a space of special relevance in Indian music. It acts as a key to the artist's musical expression and is a characteristic of raga. Describing intonation is important for several music retrieval tasks like developing similarity measures based on artists and ragas. In this paper, firstly the intonation of the raga is assessed quantitatively analyzing varnams, a specific form of carnatic music composition. Then the task of automatically procuring a compact representation of the intonation of a recording from its pitch track is done. Two approaches are proposed based on parameterization of pitch value distribution: context-based swara distributions and performance pitch histograms procured by classifying pitch contours rooted to the melodic context. Both the approaches are evaluated based on a large collection of carnatic music and their merits and demerits are discussed. Finally, different types of contextual information are went through that can be procured for improving the two approached further.

(Liu) Zimmerson's research on children's music conservation to adult listeners investigated the ability of participants of conserving melody under various harmonic conditions. Specifically, investigations on whether the listeners in study are able to identify melody when primary, diatonic and secondary chords were incorporated (Task 1) and when the melody was harmonized in a different manner (Task 2) were done. In addition, were they able to distinguish melody from harmony (Task 3)? 34 pairs of samples were listened by participants (N=80) and recognized whether the melody was different or same in each pair. Results showed that (a) regardless of harmonic conditions, a melody with the addition of harmony can be conserved by the listeners, (b) the melody could be conserved when the harmony was changed, but conserving the melody was significantly better when the harmony was changed from primary to diatonic chords than from primary to secondary chords, and (c) the dissociation of melody from harmony could be done, but with diatonic chords it was significantly better than that of secondary chords. As Task 3 is the reverse of Task 1, the discovery that the adult listeners conserved in one direction (Task 1) but not necessarily in the opposite direction (Task 3) and vice versa suggests that the musical reversibility exists.

(O Buonviri) investigated the study investigated the effect of preparatory contextual singing pattern on melodic dictation test scores. Forty-nine undergraduate music education majors took the melodic dictation under three conditions. After listening to an orienting chord sequence, (1) In the first condition, a preparatory solfege pattern in meter, tempo and key of the target dictation were sung by them; (2) In the second condition, silent preparation was done by them for an equal time interval; and (3) In the third condition, the dictations were taken immediately by them. Repeated measures ANOVA and post NOC analysis revealed that the participants who heard the dictation soon after following the chord sequence scored significantly higher than when the preparatory pattern was sung first. The singing task in addition may have distracted the participants, interfering with their focus on ensuing dictation. A variety of strategies for preparation were reported in case of silent interval condition, including that the dictation students will be able to benefit by learning a variety of strategies and they will be free to choose the strategy that will work the best for themselves. Researches in the future may investigate the connections between the strategies used during the dictation and just before the dictation. The suggestions for music educators comprise the need of careful decisions with regard to how and when to combine task involving music for student learning.

Based on the literature review, the methods are developed for the music notations. The symbol and diagrammatic notations are very simple and easy manner for childhood learners. The computerized displaying notes are trouble-free to play in all kind of instruments. It is clear that the numerical methods of musical notations are not implemented so far. In this work, the numerical equation generated for all major and minor chords for trouble free understanding the fundamental of music notes and octaves. The methods of music notations and equations are discussed by succeeding chapter.

3. Methods

Generally 12 tones called as octaves are using to create the complete collection of western music. The traditional language of western music is basically followed by alphabets and symbols. The 12 tones are located as tonic solfa such as Do, Ra, Re, Me, Mi, Fa, Se, So, Le, La, Te, Ti and Do. For trouble-free communication, it is mentioned as C, $C^{\#}$, D, $D^{\#}$, E, F, $F^{\#}$, G, $G^{\#}$, A, $A^{\#}$, B and C as shown in Figure 1.

The standard western music starts with first note is C and followed by all notes as mentioned in Figure 1. The main two groups of major and minor chords are played a vital role of western music. The major and minor chords are framed by the basic notes as shown in Figure 1. In this invention, it is framed by numerical Equation by major and minor chords. The first tone of C is called as a FULL note and the adjacent tone of C# is called as a HALF note for the C tone. If considered as the tone of C# is FULL note means the adjacent tone of D is denoted as a HALF note for the C# tone. The movements of HALF and FULL notes of one octave are shown in Figure 2.

The Figure 2 shows step by step movement starts from first note of C to end note of C. If the arrow is moving one step from one note to another note like C to C# is called HALF note and it is denoted as ‘1’. Similarly the arrow is moving to two steps like C to D is called FULL note and it is denoted as ‘2’.

Major chord

Generally, the C E G notes are selected form octave is called as C major chord and it is not clear clarification for selecting the notes of C E G from literature survey. In this work, the way of representing on C major chord by numerical equation. The numerical Equation is generated by movement of arrow form C to C from Figure 2 is mentioned in Equation 1.

$$C\ Major\ =\ 3131 \tag{1}$$

The Numerical Equation 1 is mentioned Three FULL notes, one HALF note, three FULL notes and 1 HALF note. From the Equation 1, numerical numbers are 3, 1, 3 and 1 are mentioned in top the Figure 3 and the first number ‘3’ is indicating three FULL notes in the octave. Always the first note of the chord (for example C major) is considered as a FULL note.

For C major chord, the first default FULL note is ‘C ‘, second FULL note moves from ‘C’ to ‘D’ and third FULL note moves from ‘D’ to ‘E’. The second step of movement is mentioned in the Equation number is ‘1’ and it moves HALF note from ‘E’ to ‘F’. Similarly three FULL notes moving from ‘F’ to ‘B’ and one Half note moves from ‘B’ to ‘C’ are mentioned as per the remaining Equation num-

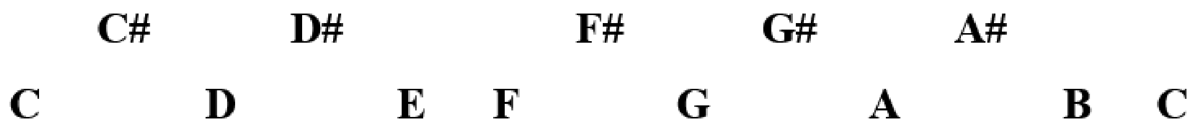

FIGURE 1. Basic Alphabets of Music Tones

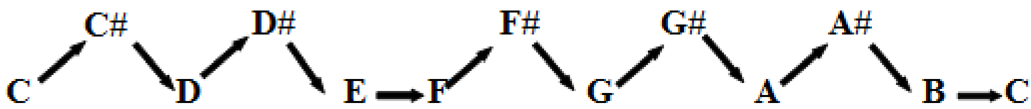

FIGURE 2. Movements of HALF and FULL Notes

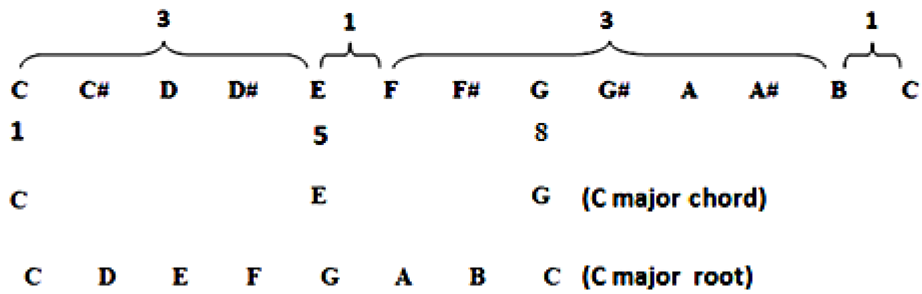

FIGURE 3. C Major Chord and Root

bers of ‘3’ and ‘1’. It is clear that the all two one’s are considered as a HALF note and all two three’s considered as a FULL note in Equation 1. Totally seven notes are called as root of the C major and the selection of first ,fifth and eight notes from octave are called as C major chord as shown in Figure 3. The first chord of C major and root are developed by numerical method. Similarly the second chord of D major and root from octave is shown in Figure 4.

C Minor chord

Similarly the C minor chord is mentioned two FULL notes, one HALF note, two FULL notes, one HALF note and two FULL notes in Equation 2. From the Equation 2, numerical numbers are 2, 1, 2, 1 and 2 are mentioned in the Figure 4 and the first number ‘2’ is indicating two FULL notes in the octave. Always the first note of the chord (for example C minor) is considered as a FULL note.

$$C\ Minor\ =\ 21212\ E$$

For C minor chord, the first default FULL note is ‘C ‘, second FULL note moves from ‘C’ to ‘D’. The second step of movement is mentioned in the Equation is ‘1’ and it moves HALF note from ‘D’ to ‘D#’. Similarly next two FULL notes moving from ‘D#’ to ‘G’, one Half note moves from ‘G’ to ‘G#’ and two FULL notes moving from ‘G#’ to ‘C’ are mentioned as per the remaining Equation numbers of ‘2’, ‘1’ and ‘2’. It is clear that the all two one’s are considered as a HALF note and all three two’s are considered as a FULL note in Equation 2. Totally seven notes are called as root of the C minor and the selection of first ,third and fifth notes are called as C minorr chord as shown in Figure 5. The first chord of C major and root are developed by numerical method. Similarly, the second chord of D minor octave root and is shown in Figure 6.

4. Discussion

The full set of major chords and roots are framed by numerical expression of first three FULL notes, one HALF note, three FULL notes and one HALF note (3131) as shown in Figure 6. It is the simplest form numerical method for identifying all major chords. These chords are very easy to understand through the numerical formulation.

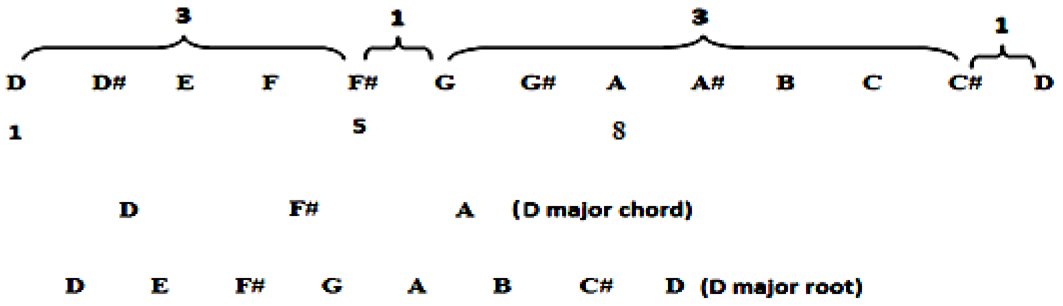

FIGURE 4. C Major Chord and Root

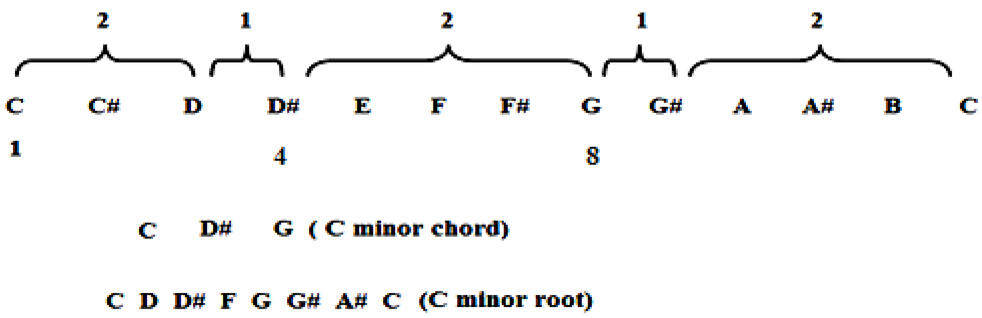

FIGURE 5. C minor chord and root

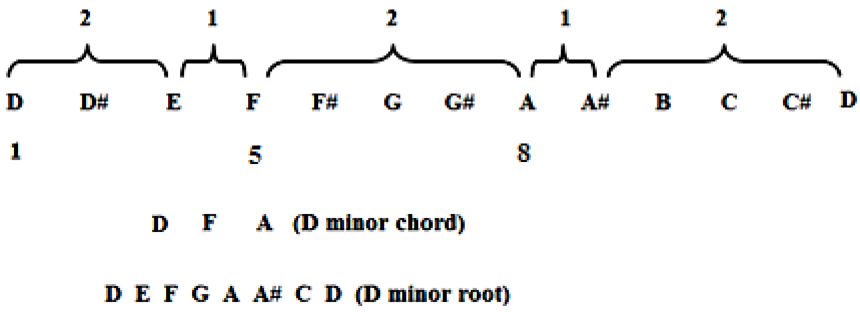

FIGURE 6. D minor chord and root

From Figure 7, all major chords and roots are selected as per the numerical expression notes of 3131 and it is mentioned in the Table 1.

The full set of minor chords and roots are framed by numerical expression of first two FULL notes, one HALF note, two FULL notes, one HALF note and two FULL notes (21212) as shown in Figure 8. It is the simplest form numerical method for indentifying all major chords. These chords are very easy to understand through the numerical formulation.

From Figure 8, all minor chords and roots have been selected as per the numerical expression notes of 21212 and it is mentioned in the Table 2.

Special chords

The major and minor chords are clearly identified through numerical expression for trouble-free understanding formats. Figure 8 is shows that the various special chords of C major are also generated by numerical expression. Generally, the octaves are indentified by MO is called middle octave, RO1 is called as first right octave, RO2 is called as second right octave and LO1 is called as first left octave. The each and every note has mentioned by numbers in all octaves as shown in Figure 9.

The middle octave notes of numbers are mentioned from 1 to 12 and it is called as MO. The first right octave numbers are mentioned from 1^1 to $12^1$and it is denoted as RO1. Similarly 1_1 indicating

		3			1			3			1	
C	C#	D	D#	E	F	F#	G	G#	A	A#	B	C
C#	D	D#	E	F	F#	G	G#	A	A#	B	C	C#
D	D#	E	F	F#	G	G#	A	A#	B	C	C#	D
D#	E	F	F#	G	G#	A	A#	B	C	C#	D	D#
E	F	F#	G	G#	A	A#	B	C	C#	D	D#	E
F	F#	G	G#	A	A#	B	C	C#	D	D#	E	F
F#	G	G#	A	A#	B	C	C#	D	D#	E	F	F#
G	G#	A	A#	B	C	C#	D	D#	E	F	F#	G
G#	A	A#	B	C	C#	D	D#	E	F	F#	G	G#
A	A#	B	C	C#	D	D#	E	F	F#	G	G#	A
A#	B	C	C#	D	D#	E	F	F#	G	G#	A	A#
B	C	C#	D	D#	E	F	F#	G	G#	A	A#	B

FIGURE 7. Full Set of Basic Major chord Octaves

TABLE 1. Full Set of Basic Major Roots and Chords

Name of the chord	Root	Major Chord	Name of the chord	Root	Major Chord
C	C D E F G A B C	C E G	**F#**	F# G# A# B C# D# F F#	F# A# C#
C#	C# D# F F# G# A# C C#	C# F G#	**G**	G A B C D E F# G	G B D
D	D E F# G A B C# D	D F# G	**G#**	G# A# C C# D# F G G#	G# C D#
D#	D# F G G# A# C D D#	D# G A#	**A**	A B C# D E F# G# A	A C# E
E	E F# G# A B C# D# E	E G# B	**A#**	A# C D D# F G A A#	A# D F
F	F G A A# C D E F	F A C	**B**	B C# D# E F# G# A# B	B D# F#

LO1 is the first left octave as shown in Figure 9 and the numbers are indicated in all notes and octaves. The various special chords related to C major are developed by numerical expression. The chord names and notes and corresponding numbers taken from Figure 8 as shown in Table 3. For example, first chord of the Table 3 is C Sus 2 notes of C D G are indicated 1 3 8 taken from the set of octaves in Figure 9. Similarly, all the C major relation chords are mentioned with numerical expression in Table 3.

2 1 2 1 2

C	**C#**	**D**	**D#**	**E**	**F**	**F#**	**G**	**G#**	**A**	**A#**	**B**	**C**
C#	**D**	**D#**	**E**	**F**	**F#**	**G**	**G#**	**A**	**A#**	**B**	**C**	**C#**
D	**D#**	**E**	**F**	**F#**	**G**	**G#**	**A**	**A#**	**B**	**C**	**C#**	**D**
D#	**E**	**F**	**F#**	**G**	**G#**	**A**	**A#**	**B**	**C**	**C#**	**D**	**D#**
E	**F**	**F#**	**G**	**G#**	**A**	**A#**	**B**	**C**	**C#**	**D**	**D#**	**E**
F	**F#**	**G**	**G#**	**A**	**A#**	**B**	**C**	**C#**	**D**	**D#**	**E**	**F**
F#	**G**	**G#**	**A**	**A#**	**B**	**C**	**C#**	**D**	**D#**	**E**	**F**	**F#**
G	**G#**	**A**	**A#**	**B**	**C**	**C#**	**D**	**D#**	**E**	**F**	**F#**	**G**
G#	**A**	**A#**	**B**	**C**	**C#**	**D**	**D#**	**E**	**F**	**F#**	**G**	**G#**
A	**A#**	**B**	**C**	**C#**	**D**	**D#**	**E**	**F**	**F#**	**G**	**G#**	**A**
A#	**B**	**C**	**C#**	**D**	**D#**	**E**	**F**	**F#**	**G**	**G#**	**A**	**A#**
B	**C**	**C#**	**D**	**D#**	**E**	**F**	**F#**	**G**	**G#**	**A**	**A#**	**B**

FIGURE 8. **Full Set of Basic Minor chord Octaves**

TABLE 2. **Full Set of Basic Major Roots and Chords**

Name of the chord	Root	Major Chord	Name of the chord	Root	Major Chord
C	C D D# F G# A# C	C D# G	**F#**	F# G# A B C# D E F#	F# A C#
C#	C# D# E F# A B C#	C# E G#	**G**	G A A# C D D# F G	G A# D
D	D E F G A A# C D	D F A	**G#**	G# A# B C# D# E F# G#	G# B D#
D#	D# F F# G# A# B C# D#	D# F# A#	**A**	A B C D E F G A	A C E
E	E F# G A B C D E	E G B	**A#**	A# C C# D# F F# G# A#	A# C# F
F	F G G# A# C C# D# F	F G# C	**B**	B C# D E F# G A B	B D F#

5. Conclusion

The numerical representation of music chord methodology may reduce the work load of music teaching Staff. Students can read the numerical scores to achieve their musical representation goals. The notation and other tablature types of notes are complicated to understand for the learning peoples. In this work, all type's major and minor chords are generated by numerical representation and denoted

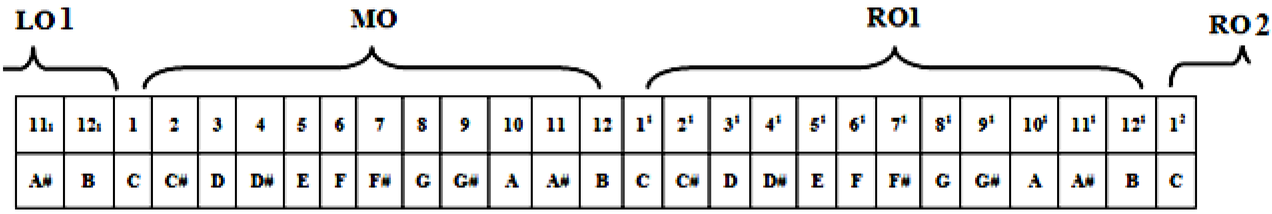

FIGURE 9. Octaves and Numbers

TABLE 3. Numerical expressions of C major relation chords

Sl.No	Name of the Chord and Notes	Numerical Representation
1	C Sus 2 - C D G	(1 3 8)
2	C Sus 4 - C F G	(1 6 8)
3	C 6 - C E G A	(1 5 8 10)
4	C Major 7 - C E G B	(1 5 8 12)
5	C Diminished - C D# F#	(1 4 7)
6	C Diminished 7 - C D# F# A	(1 4 7 10)
7	C Half Diminished 7 - C D# F# A#	(1 4 7 11)
8	C Augument - C E G#	(1 5 9)
9	C Augument 7 - C E G# A#	(1 5 9 11)
10	C Augument Major 7 - C E G# B	(1 5 9 12)
11	C Add 9 - C E G D	(1 5 8 3^{1})
12	C Seventh Flat Five - C E F# A#	(1 5 7 11)
13	C Major 9 - C E G B D	(1 5 8 12 3^{1})
14	C Dominant 9 - C E G A# D	(1 5 8 11 3^{1})
15	C Major 11 - C E G B D F	(1 5 8 12 3^{1} 6^{1})
16	C Augument Major 11 - C E G# B D F	(1 5 9 12)
17	C Augument 11 - C E G# A# D F	(1 5 9 11 3^{1} 6^{1})
18	C Half Diminished 11- C D# F# A# D F	(1 4 7 11 3^{1} 6^{1})

the numbers for easy to select the required notes from the octaves. Octaves are defined numerically and chord notes and roots are identified clearly. This numerical equation can applicable for all types of music chords and easy to write when compared to other types of notations. Beginners can also recognize finger position easily and precisely when reading the numerical notes of major and minor chords.

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