

In Search of Sudokus with Good Alignment Properties for Musical Composition

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ISE575 / EE675 Final Project, Spring 2007

Introduction

The concept for this project was given by Professor Tamar Diesendruck who is a visiting associate professor of composition at USC. She favors virtuosic chamber music as a compositional medium although she has also composed solo, orchestral and vocal works. She earned an M.A. and Ph.D. in composition from university of California, Berkley and a B.A. from Brandies University.

The whole idea of this project is to relate music with sudoku grid and find out the alignments. It is fun to generate music using a sudoku grid and find out which grid gives the music which sounds good to hear.

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Music and Mathematics ??????

Let use see what great philosopher and mathematicians have to say about this:

Francois Nicolas says:

- What comes out of loudspeaker is image of the music
- Listening to music is not necessarily acoustical perception
- Number did not begin with music
- **Music is number**

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What is Sudoku???

- **Sudoku** is a logic-based number placement puzzle
- The objective is to fill 9*9 grid so that each column, each row, and each of the nine 3*3 boxes contains the digits from 1 to 9.

5	3		7					
6			1	9	5			
	9	8				6		
8			6					3
4			8		3			1
7				2				6
	6					2	8	
			4	1	9			5
				8			7	9

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Sudoku and Music Generation

So now the question arises how can we relate music and sudoku?

Sudoku is nothing but can be seen as a grid with different numbers. Now the idea is to assign each number a piece of music.

Which means there are 9 different music piece each related to each number from 1 to 9.

So now when we play the sudoku grid it means we will take each row one by one and play music piece related to each number in that row continuously.

Each row sums upto 45 which means that if we play each row it will play for the same time given we assign each number a music which is proportional to that number.

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Concept of Alignment

Will explain this concept with the help of an example:
Let us take a sudoku grid:

5	3	4	6	7	8	9	1	2
6	7	2	1	9	5	3	4	8
1	9	8	3	4	2	5	6	7
8	5	9	7	6	1	4	2	3
4	2	6	8	5	3	7	9	1
7	1	3	9	2	4	8	5	6
9	6	1	5	3	7	2	8	4
2	8	7	4	1	9	6	3	5
3	4	5	2	8	6	1	7	9

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Concept of Alignment contd...

We first see the first three rows of the sudoku grid:

5	3	4	6	7	8	9	1	2
6	7	2	1	9	5	3	4	8
1	9	8	3	4	2	5	6	7

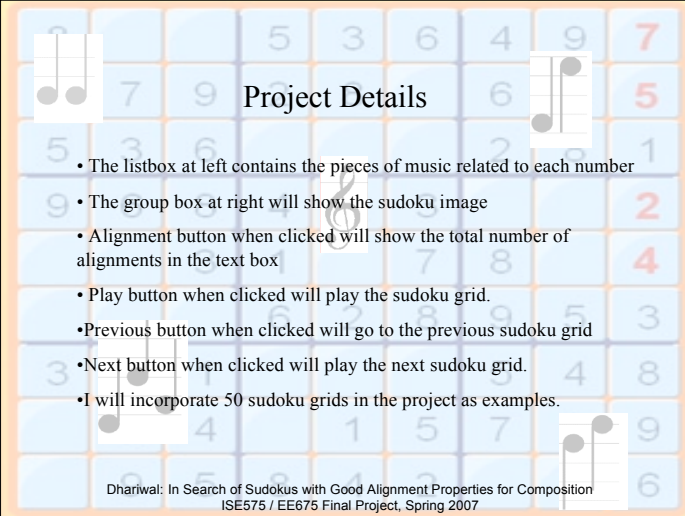
The time of the music related to each number is directly proportional to the number. For example if the music for number plays for 1 second the music for the number two will play for 2 seconds and so on and so forth. We will take each second as beat.

Let us see on the next slide the timing diagram for the first three rows.

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We see that each row can be divided into 45 columns, as if we add the total time for each row it will be 45. We assign each number a color. Now we see that 1st and second row coincide on 25th beat and 33rd beat so we will count it as 2 alignments. Now we see that 1st and 3rd row coincide at 25th beat. In all there are 3 alignments for 1st row.

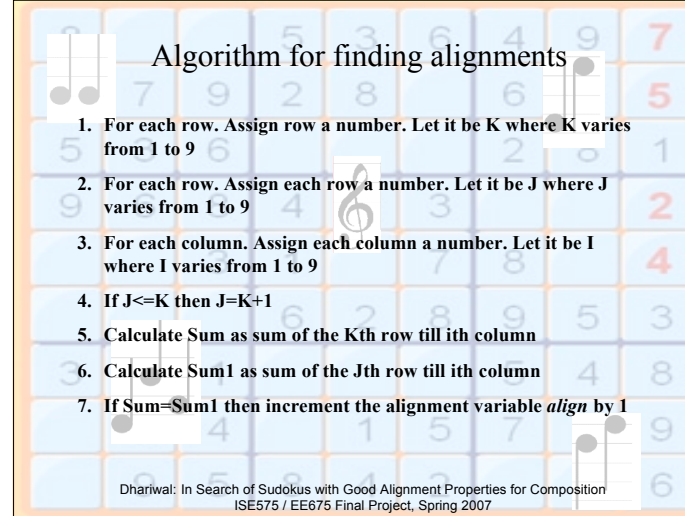
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Project Details

- The listbox at left contains the pieces of music related to each number
- The group box at right will show the sudoku image
- Alignment button when clicked will show the total number of alignments in the text box
- Play button when clicked will play the sudoku grid.
- Previous button when clicked will go to the previous sudoku grid
- Next button when clicked will play the next sudoku grid.
- I will incorporate 50 sudoku grids in the project as examples.

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Algorithm for finding alignments

1. For each row. Assign row a number. Let it be K where K varies from 1 to 9
2. For each row. Assign each row a number. Let it be J where J varies from 1 to 9
3. For each column. Assign each column a number. Let it be I where I varies from 1 to 9
4. If $J \leq K$ then $J = K + 1$
5. Calculate Sum as sum of the Kth row till ith column
6. Calculate Sum1 as sum of the Jth row till ith column
7. If $Sum = Sum1$ then increment the alignment variable *align* by 1

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- I would like to sincerely thank Professor Elaine for guiding me through this project and helping me understand this project.
- Any improvements and suggestions are most welcome.

THANK YOU!!!

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