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Final Project: Random Short Piece for Solo Flute

In a Random Short Piece for Solo Flute, the piece would be constructed using the Golden ratio, random procedures, and a markov chain.

The length of the entire piece will be determined by the Golden ratio, which can be described as a ratio of $a+b/a = a/b = \Phi$, where $\Phi = 1.618$. With this in mind, the piece will consist of 3 sections: section A, section B, and section AB. Section A will consist of 30 measures, while section B will consist of 18 measures, resulting in section AB having 48 measures. This will achieve the following equation, giving us a Golden ratio for the piece:

$$(30+18)/30 = 1.6 \qquad 30/18 = 1.6$$

The piece will be in 4/4 time, with a bpm of 60. This will result in the piece's length being a total of ~6 minutes, with 96 measures total. To generate attack points in the piece, random procedure will be used. In this case, there will be a 50/50 chance for there to be silence or a sound. The duration of the silence or sound will be determined at random with the following procedure:

A random number generator will choose a value 1-7, which will decide the duration based on the following:

Eighth note = 1	Quarter note = 2	Dotted quarter note = 3
Half note = 4	Dotted half note = 5	Whole note = 6

If a sound is chosen, the pitch will be determined by the following transitional matrix of a Markov chain.

	C	C#	D	D#	E	F	F#	G	G#	A	A#	B
C	.05	.15	.05	.10	.05	.10	.05	.05	.15	.10	.10	.05
C#	.15	.05	.10	.05	.10	.05	.05	.15	.10	.10	.05	.05
D	.05	.10	.05	.10	.05	.05	.15	.10	.10	.05	.05	.15
D#	.10	.05	.10	.05	.05	.15	.10	.10	.05	.05	.15	.05
E	.05	.10	.05	.05	.15	.10	.10	.05	.05	.15	.05	.10
F	.10	.05	.05	.15	.10	.10	.05	.05	.15	.05	.10	.05
F#	.05	.05	.15	.10	.10	.05	.05	.15	.05	.10	.05	.10
G	.05	.15	.10	.10	.05	.05	.15	.05	.10	.05	.10	.05
G#	.15	.10	.10	.05	.05	.15	.05	.10	.05	.10	.05	.05
A	.10	.10	.05	.05	.15	.05	.10	.05	.10	.05	.05	.15
A#	.10	.05	.05	.15	.05	.10	.05	.10	.05	.05	.15	.10
B	.05	.05	.15	.05	.10	.05	.10	.05	.05	.15	.10	.10

To determine the pitch manually, the transitional matrix has been translated into the following in order to determine the pitch with a random number generator of 1-100. Each pitch has a number range that is correspondent to the above percentages, and the pitch used in the piece will be whatever range the generated number falls into.

	C	C#	D	D#	E	F	F#	G	G#	A	A#	B
C	1-5	6-20	21-25	26-35	36-40	41-50	51-55	56-60	61-75	76-85	86-95	96-100
C#	1-15	16-20	31-30	31-35	36-45	46-50	51-55	56-70	71-80	81-90	91-95	96-100
D	1-5	6-15	16-20	21-30	31-35	36-40	41-55	56-65	66-75	76-80	81-85	86-100
D#	1-10	11-15	16-25	26-30	31-35	36-50	51-60	61-70	71-75	76-80	81-95	96-100

E	1-5	6-15	16-20	21-25	26-40	41-50	51-60	61-65	66-70	71-85	86-90	91-100
F	1-10	11-15	16-30	31-40	41-50	51-55	56-60	61-75	76-80	81-90	91-95	96-100
F#	1-5	6-10	11-25	26-35	36-45	46-50	51-55	56-70	71-75	76-85	86-90	91-100
G	1-5	6-20	21-30	31-40	41-45	46-50	51-65	66-70	71-80	81-85	86-95	96-100
G#	1-15	16-25	26-35	36-40	41-45	46-60	61-65	66-75	76-80	81-90	91-95	96-100
A	1-10	11-20	21-25	26-30	31-45	46-50	51-60	61-65	66-75	76-80	81-85	86-100
A#	1-10	11-15	16-20	21-35	36-40	41-50	51-55	56-65	66-70	71-75	76-90	91-100
B	1-5	6-10	11-25	26-30	31-40	41-45	46-55	56-60	61-65	66-80	81-90	91-100

After a pitch has been chosen, the octave of the pitch will be determined by random procedure in order to utilize the entire range of the flute. Depending on the pitch's number of available octaves (3 or 4), a random number (1-3 or 1-4) will be generated to determine the octave. Using all of the above criteria, section A of this Random Piece has been generated.

Random Piece for Solo Flute

$\text{♩} = 60$

10

20

30

For this piece, a coin flip program was used to determine whether there would be a sound or silence. Then, a number between 1-6 was randomly generated to decide the length of the sound or silence. If it was a sound, a number 1-100 was randomly generated, then the pitch was chosen based on the previous note and where it fell into in the 2nd transitional matrix above (with the exception of the very first note of the piece, which was chosen with “C” as the previous note). After the pitch was determined, a number between 1-3 or 1-4 was chosen based on the pitch’s number of available octaves to determine what octave the sounding pitch would be. This process then continued on until the 30 measures of section A were completed.

Now the piece will be analyzed using elements of Birkhoff’s Aesthetic Measure, which uses the following formula:

$$M = (\text{Originality/Redundancy}) / \text{Complexity}$$

Although there are no specific ways to measure these components, they will each be looked at with a rating of 0-10 to keep things simple, with higher numbers meaning there is more of that component present.

For **Originality**, or Information, we can look at the style of the piece. With the placement and duration of silence within the piece and the attack points coming on both strong and weak points of the beat, the piece sounds unpredictable. With that being said, it is original in the sense that a regular listener would not be able to interpret when and what sound would come next, earning it a high score of 10.

For **Redundancy**, we can look at the “normal language” of the piece. For this example, we can look at the scale used in the piece. The pitches used in this section of the piece include the following: C, C#, D, D#, E, F, F#, G, G#, A, A#, and B, all of which make up a complete chromatic scale. Normally, pieces will use certain scales or modes as a key center. In this piece, every pitch of the chromatic scale is used sporadically throughout the piece, resulting in a piece with an ungraspable key center. Due to this, we can say this piece has a high redundancy of 10, as it does not use “normal” musical language, or a specific key center.

For **Complexity**, we can look at whether or not the piece follows any conventional rules. The piece contains many leaps with various intervals, so it is hard to say whether or not it follows any rules. Due to the lack of musical rules, the piece has low complexity. However, the piece is complex in that it does not follow the conventional rule of having a key center and being unpredictable. With that being said, the piece could have a rating of 6 for complexity.

Combining the ratings results in the following Aesthetic measurement:

$$M = (10/10) / 6 = \frac{1}{6} = 0.167$$

I would interpret this as having a very low aesthetic rating, as the piece has lots of unpredictability and does not follow any conventional music rules, making the piece sound musically unaesthetic.