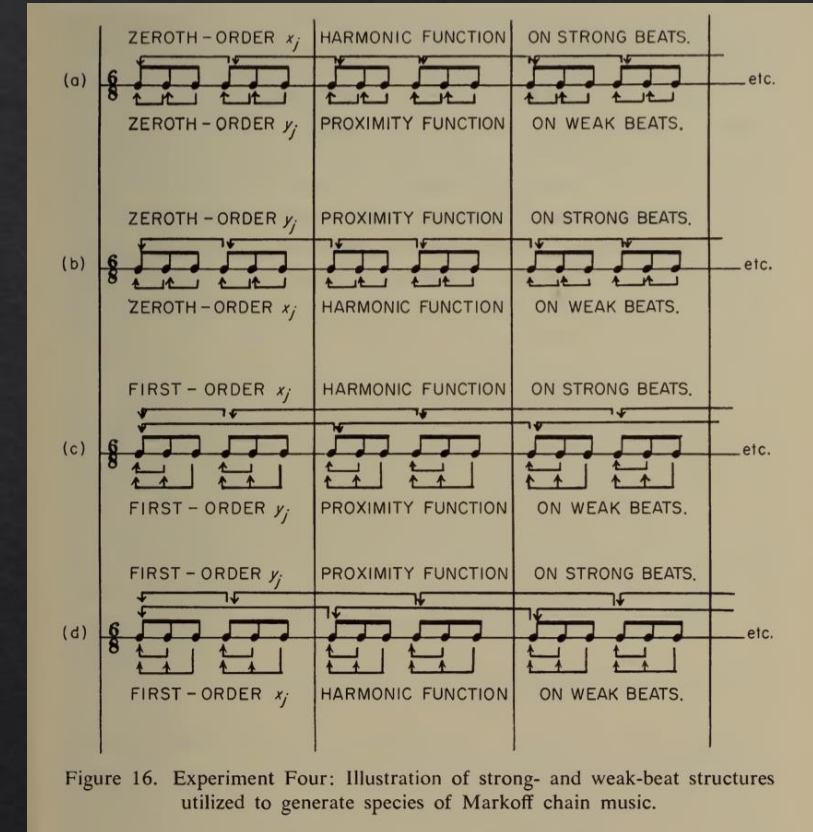
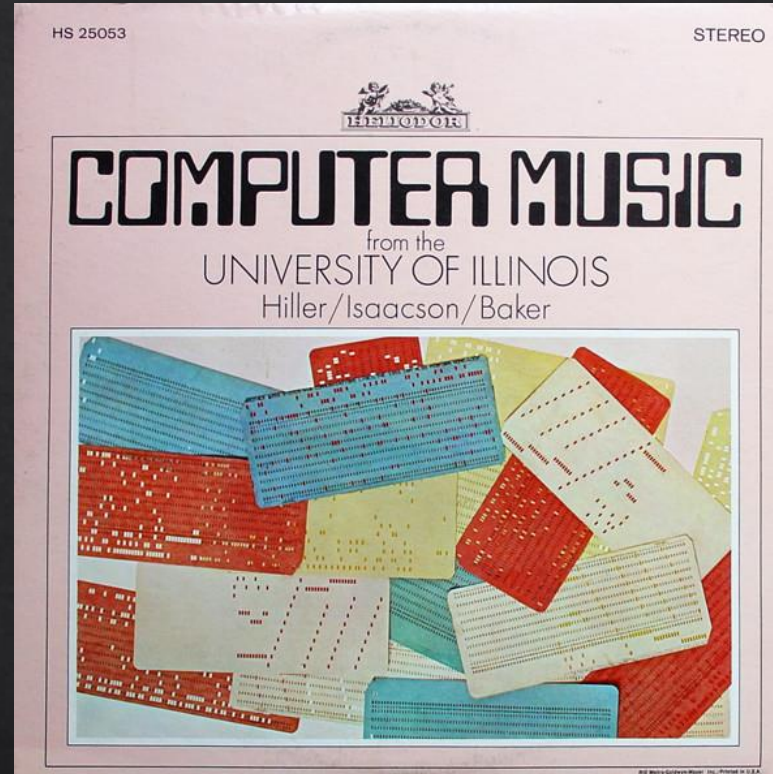
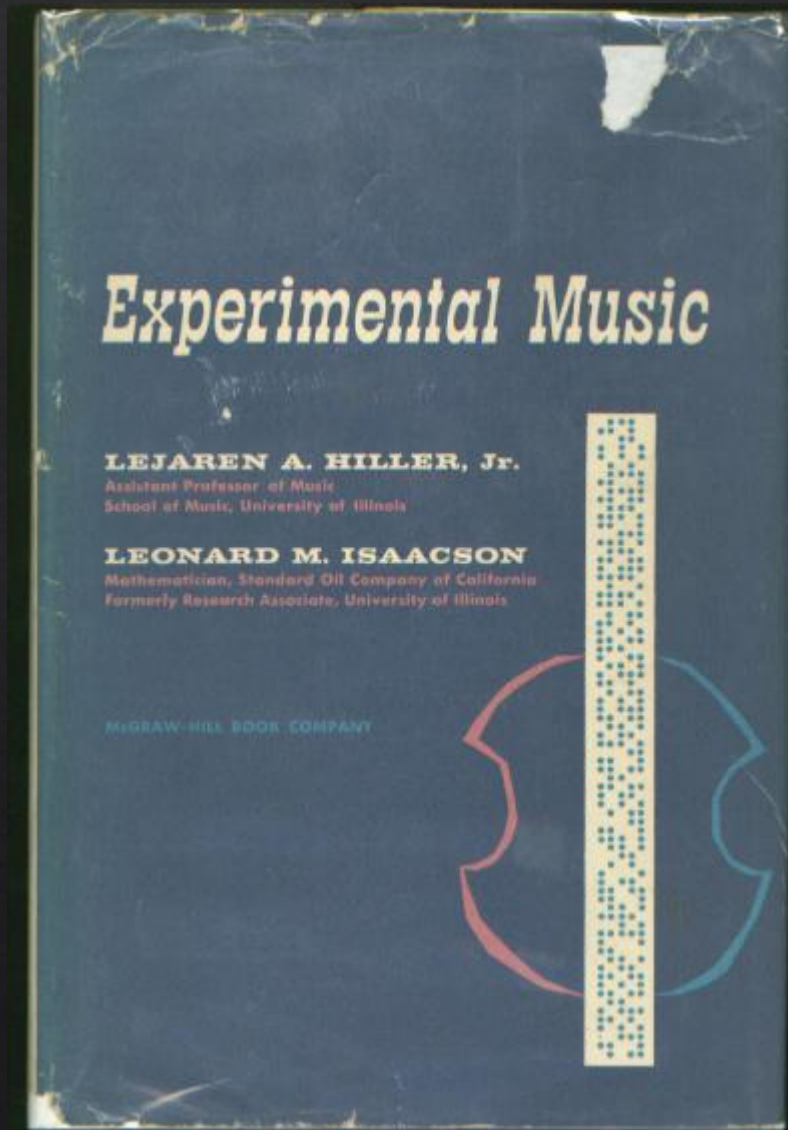


Generowanie muzyki z wykorzystaniem Łańcuchów Markowa

Lejaren Hiller Leonard Isaacson



Lejaren Hiller Leonard Isaacson

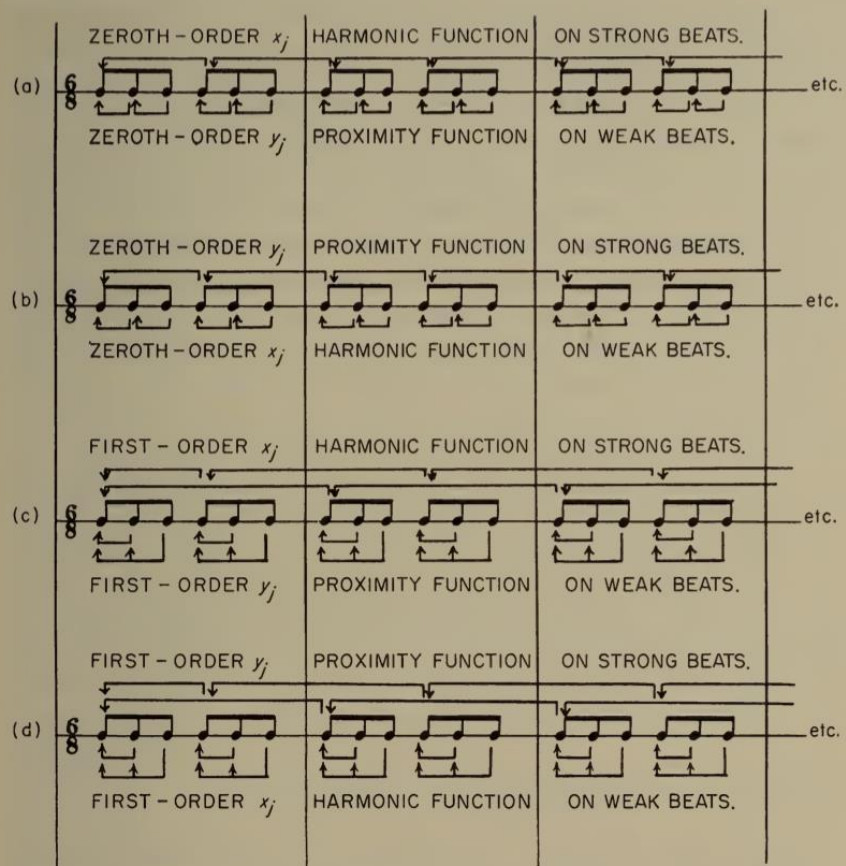
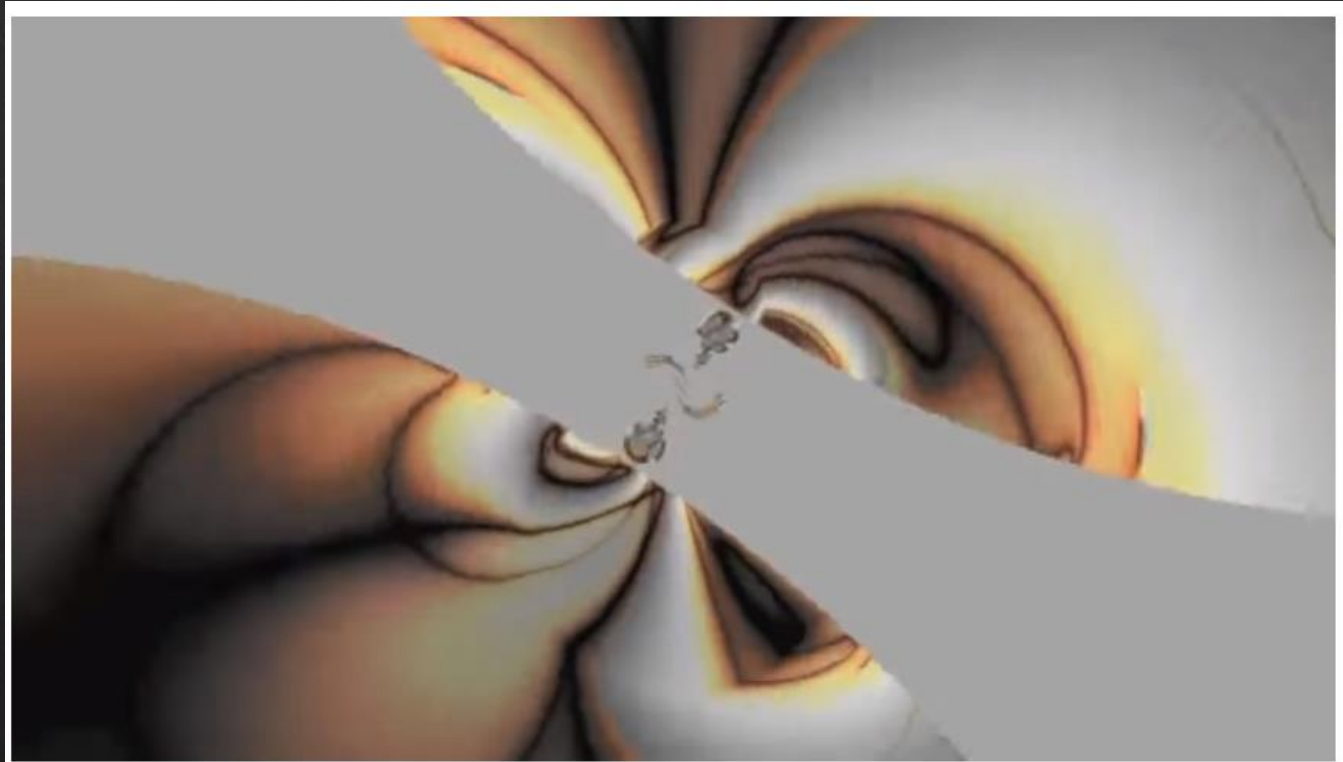


Figure 16. Experiment Four: Illustration of strong- and weak-beat structures utilized to generate species of Markoff chain music.



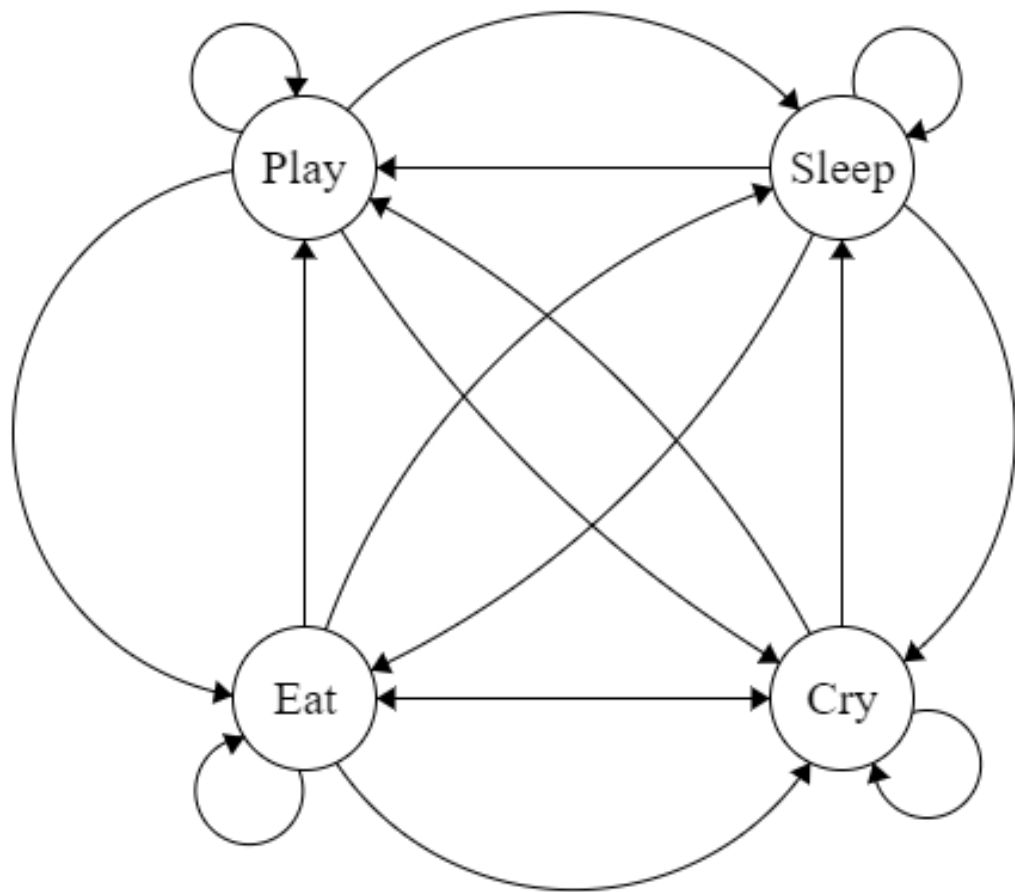
David Cope - EMI



David Cope Emmy Vivaldi

Łańcuch Markowa

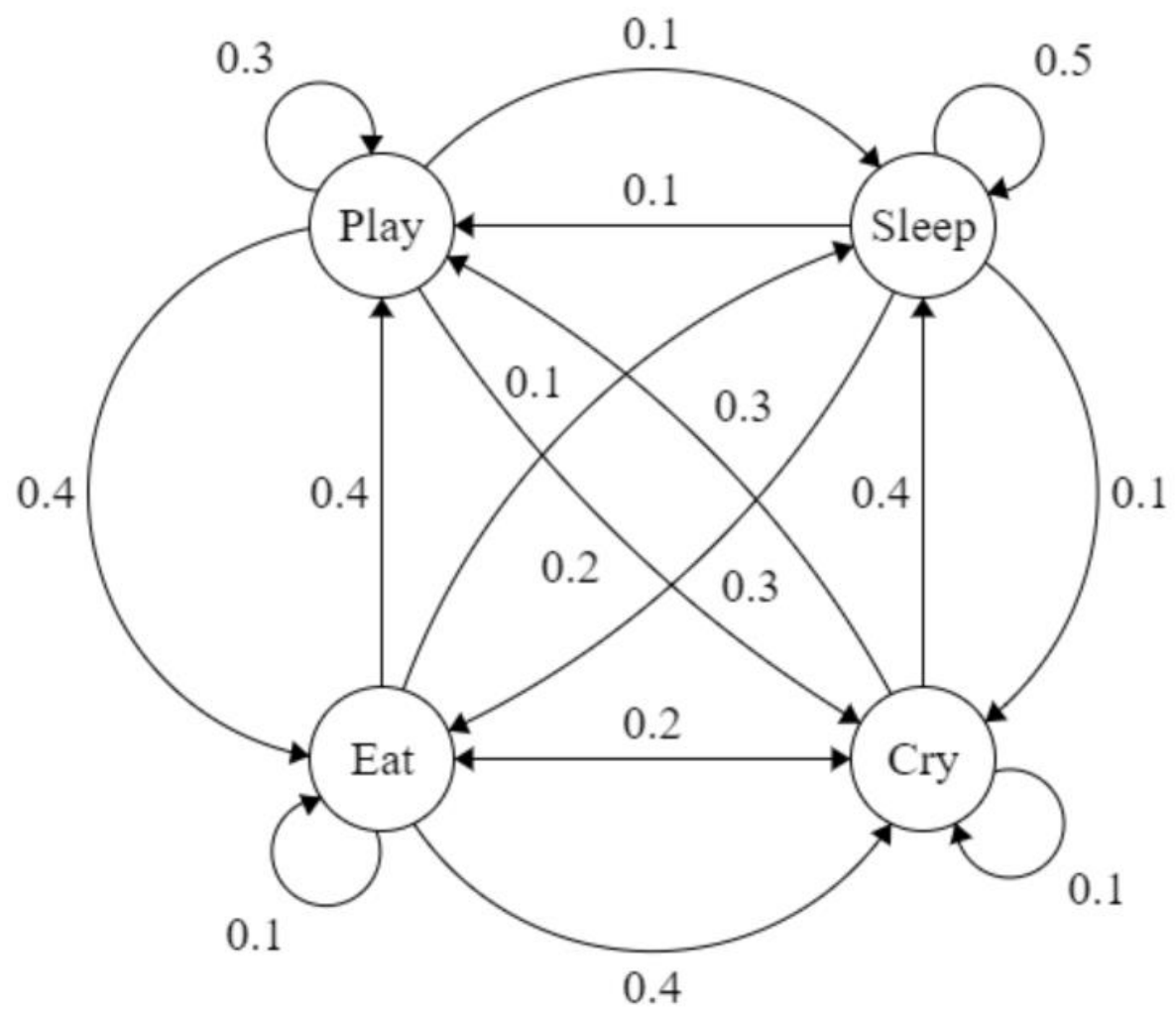
- ◆ Łańcuch Markowa opisuje sytuacje, w której zmienne losowe są zależne, ale znamy dobrze charakter tej zależności. Model ten został sformalizowany na początku XX wieku w celu modelowania systemów probabilistycznych, jest prężnie wykorzystywany w ekonomii, na giełdzie czy w algorytmie PageRank.



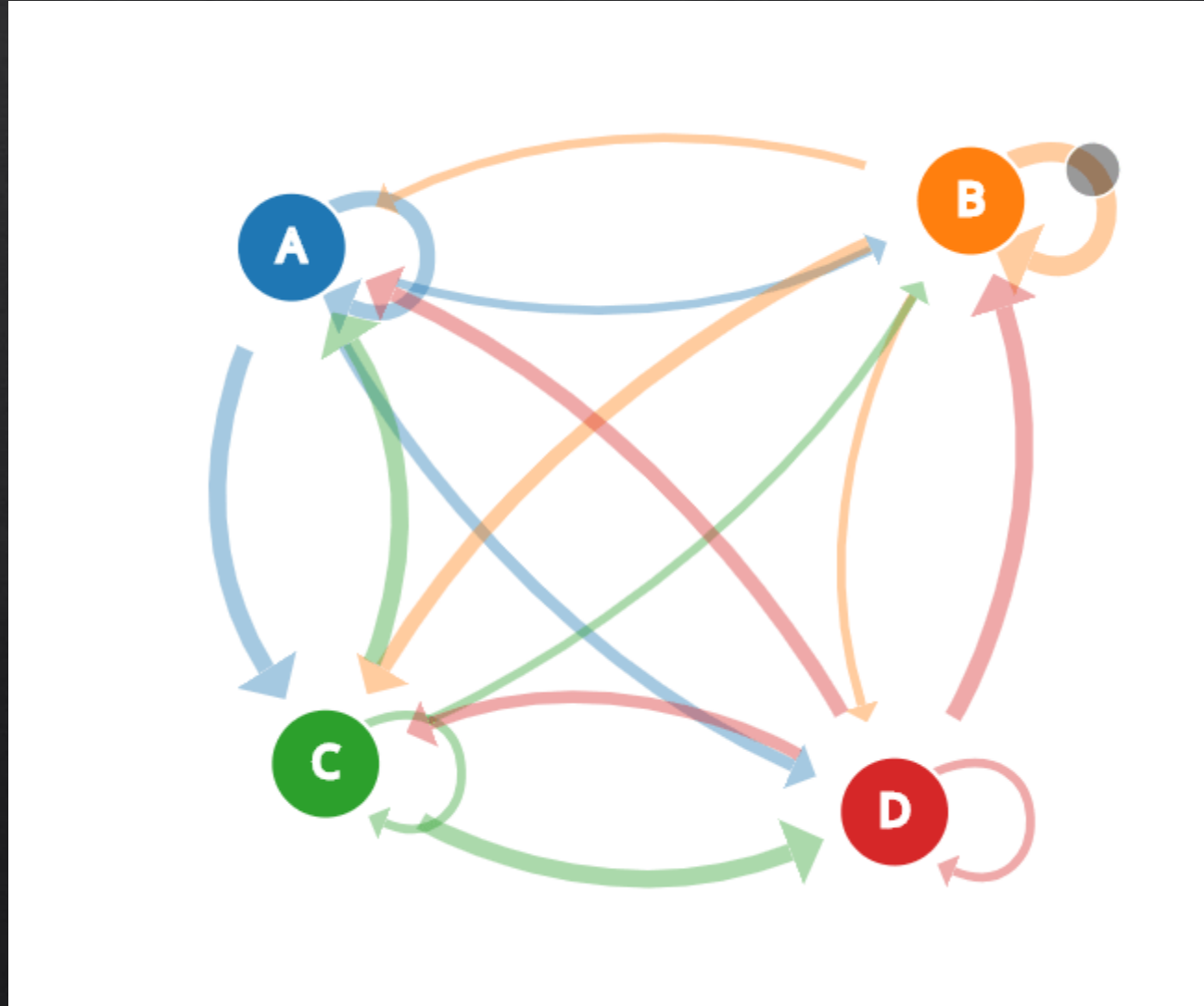
Play Sleep Eat Cry

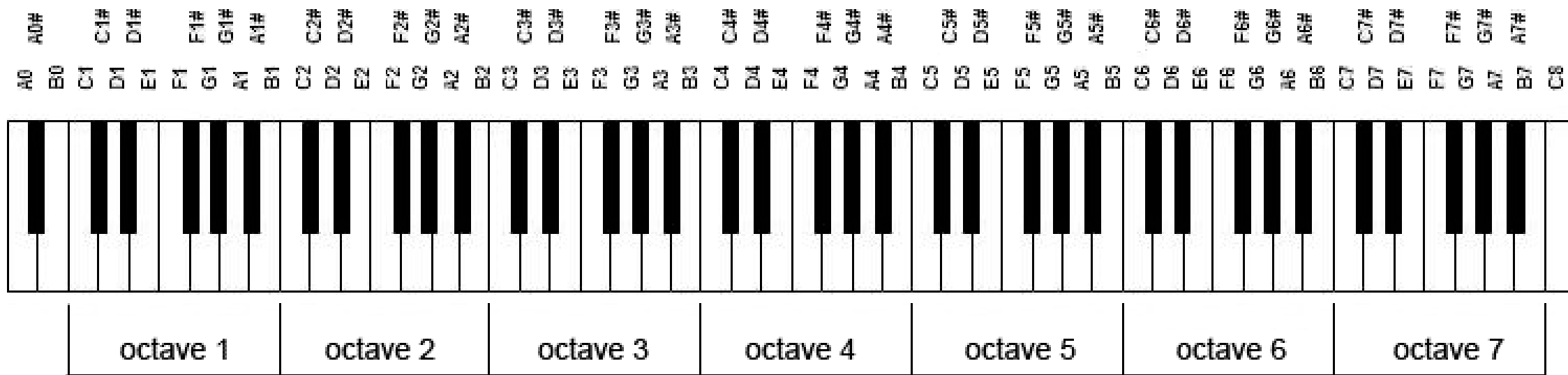
Play
Sleep
Eat
Cry

$$M = \begin{bmatrix} 0.3 & 0.1 & 0.4 & 0.2 \\ 0.1 & 0.5 & 0.3 & 0.1 \\ 0.4 & 0.1 & 0.1 & 0.4 \\ 0.3 & 0.4 & 0.2 & 0.1 \end{bmatrix}$$



A – stan Play, B – stan Sleep, C – stan Eat, D – stan Cry

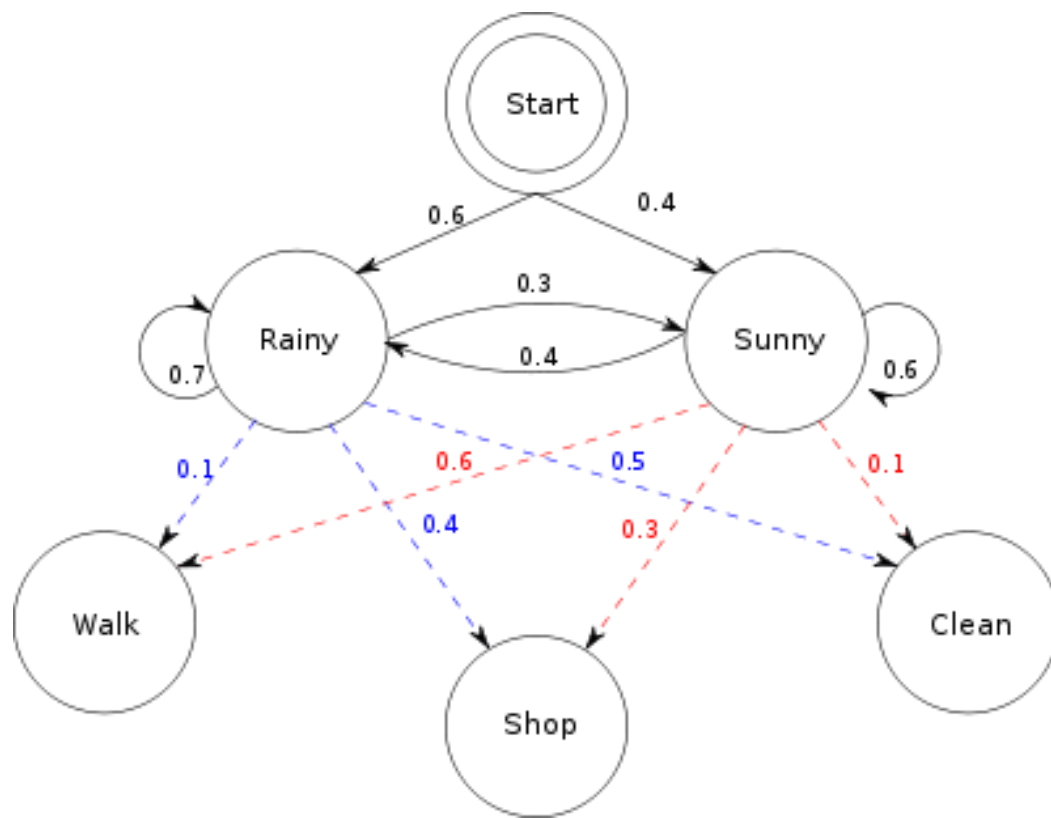




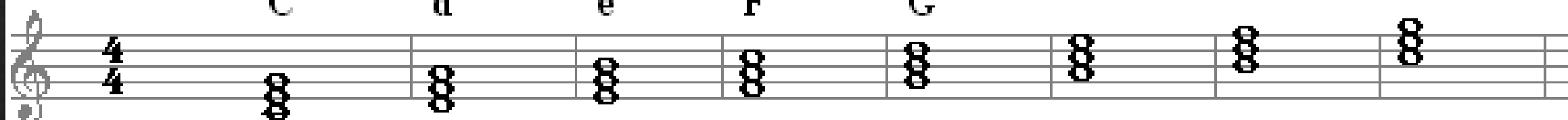
Przykład na stronie

- ◇ <https://blog.lukaszogan.com/informatyka/algorytmiczne-generowanie-muzyki-poczatek-cykladu/>

Ukryte Modele Markowa – dodatkowe cechy



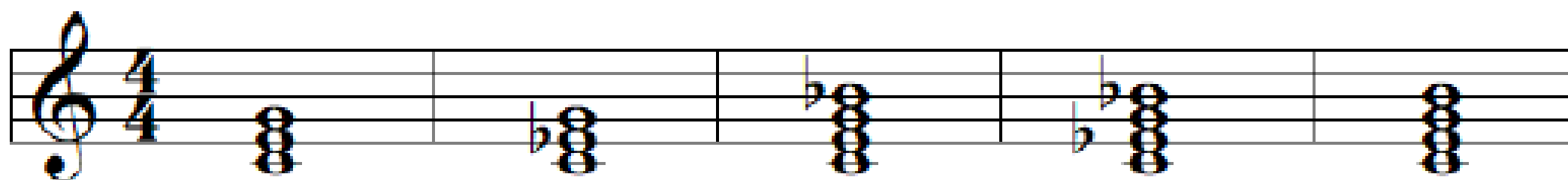
Oznaczenia
akordów ::

	C	d	e	F	G	a	Hzm	C
								

Stopnie : I II III IV V VI VII VIII = I

1-2-5-1 (I-II-V-I) CHORD PROGRESSION CHART

KEY	1(I)	2(II)	5(V)	1(I)
C Major	C	Dm	G	C
D Major	D	Em	A	D
E Major	E	F#m	B	E
F Major	F	Gm	C	F
G Major	G	Am	D	G
A Major	A	Bm	E	A
B Major	B	C#m	F#	B
C# Major	C#	D#m	G#	C#
E ♭ Major	E ♭	Fm	B ♭	E ♭
F# Major	F#	A ♭m	C#	F#
A ♭ Major	A ♭	B ♭m	E ♭	A ♭
B ♭ Major	B ♭	Cm	F	B ♭



C major

C minor

C7

C minor7

C major 7

NORMAL II-V-I IN THE KEY OF C

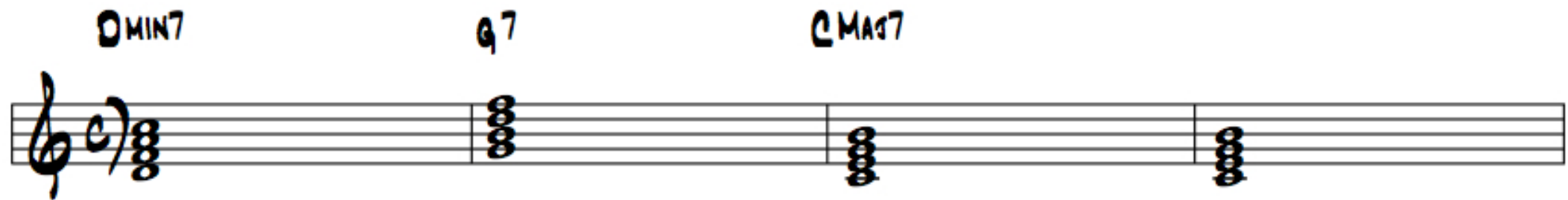
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Diagram illustrating a Normal II-V-I progression in the key of C:

The progression consists of three chords: DMIN7, G7, and CMA7.

The diagram shows a single staff with four measures, each containing a chord symbol above the staff and a corresponding chord symbol below the staff:

- Measure 1: DMIN7 (D minor 7)
- Measure 2: G7 (G dominant 7)
- Measure 3: CMA7 (C major 7)
- Measure 4: CMA7 (C major 7)



The staff is a single five-line musical staff. The first measure contains a treble clef, a common time signature 'C', and a Dm7 chord symbol above the staff. The second measure contains a G7 chord symbol above the staff. The third measure contains a Cmaj7 chord symbol above the staff. The fourth measure contains a Cmaj7 chord symbol above the staff. Below the staff, there are four groups of chord symbols corresponding to each measure: DMIN7, G7, CMA7, and CMA7.

Macierz prawdopodobieństw

	D	G	C
D	0.4	0.4	0.2
G	0.1	0.1	0.8
C	0.0	0.3	0.7

Macierz emisji typu akordu

	7	minor7	major7
7	0.4	0.4	0.2
minor7	0.1	0.1	0.8
major7	0.0	0.3	0.7

Program