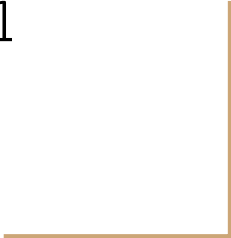


Programming, Problem Solving, and Algorithms

CPSC203, 2019 W1



Announcements

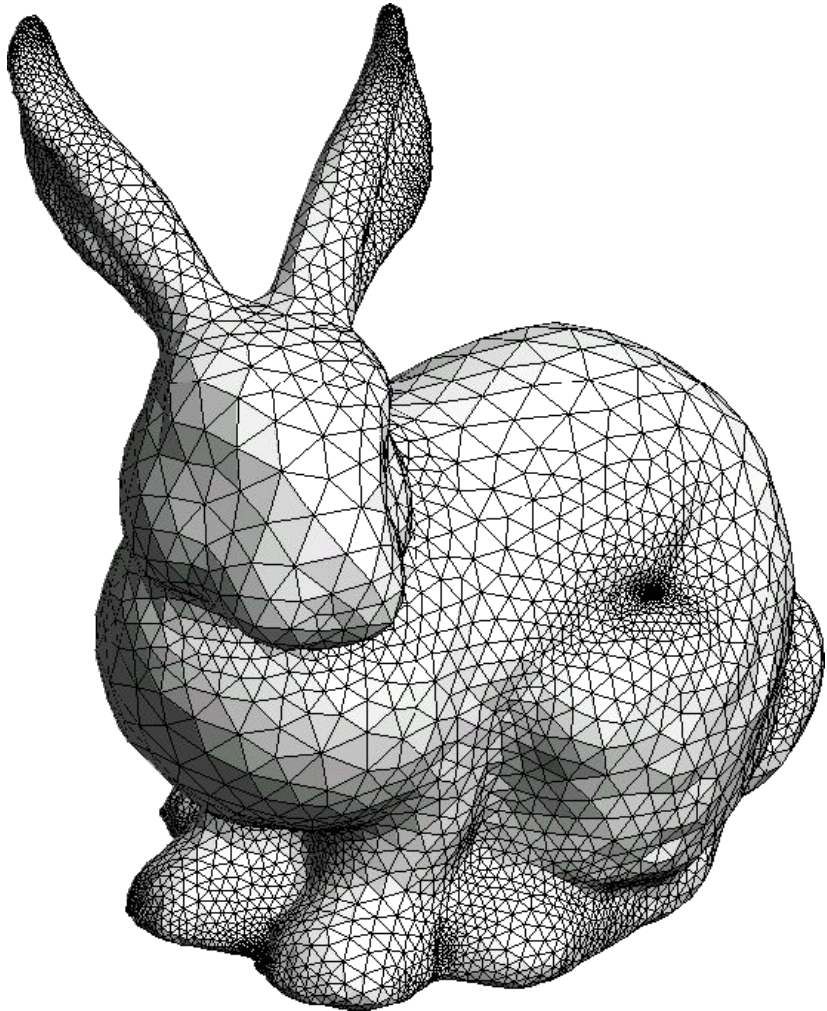
Project 1 is released. Due 11:59p, Oct 19.

“Problem of the Day” continues!

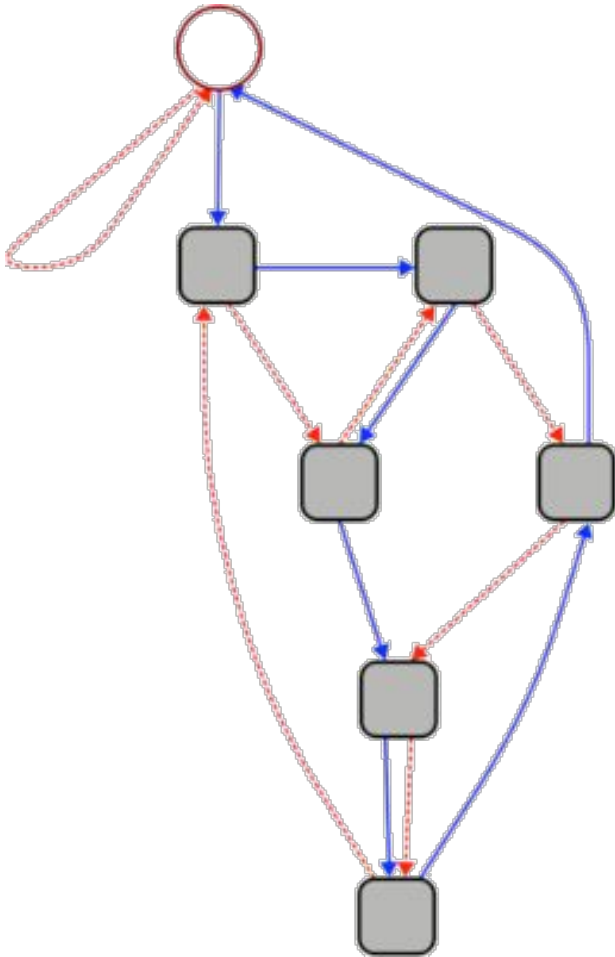
Today:

Graphs

MHALL



This graph can be used to quickly calculate whether a given number is divisible by 7.



1. Start at the circle node at the top.
2. For each digit d in the given number, follow d blue (solid) edges in succession. As you move from one digit to the next, follow 1 red (dashed) edge.
3. If you end up back at the circle node, your number is divisible by 7.

3703

The only thing that we could have a little more of the same kind words and the answers are very very important

Following Ada



Supposing, for instance, that the fundamental relations of pitched **sounds** in the science of harmony and of musical composition were **susceptible of such expression** and adaptations,

the engine might compose elaborate and scientific pieces of music of any degree of complexity or extent.

(Ada Lovelace -- 1842)

Prelude



Characterizing Mary



	C	D	E	G
C	0	2	0	0
D	3	3	4	0
E	0	5	5	1
G	0	0	1	1

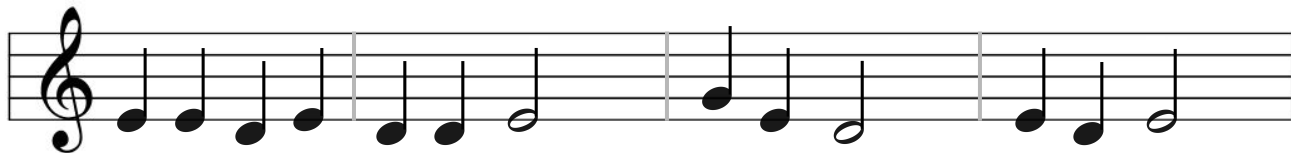
Building a Music Generator

	C	D	E	G
C	0	2	0	0
D	3	3	4	0
E	0	5	5	1
G	0	0	1	1



	C	D	E	G
C	0	1.0	0	0
D	0.3	0.3	0.4	0
E	0	0.45	0.45	0.1
G	0	0	0.5	0.5

Building a Song



1. Randomly choose a start note and put it in a list
2. for 25 notes, in the rhythm of MHaLL
 - a. Generate a new note
 - b. Put the new note in the list
3. play the list of notes

	C	D	E	G
C	0	1.0	0	0
D	0.3	0.3	0.4	0
E	0	0.45	0.45	0.1
G	0	0	0.5	0.5

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The Technical Details

You have just learned about a particular type of random process called a *Markov Chain*.

We modelled it using a *transition table*, or a *finite state machine*, and we used it as the basis for an algorithm to generate music.

Now let's look at some code!

<https://github.students.cs.ubc.ca/cpsc203-2019w-t1/LecMHALL/>

Other Applications

PageRank: Google's first search algorithm

Some pages are likely to “follow” (be linked from) others.

Rank of page is based on the probability that you'll be there at any moment

Natural Language Processing

Some words are more likely to follow others.

“I just ate the whole desert” probably has a misspelling.

“For dinner I ___ ...” next word is probably “ate”

DNA matching

Chemical reaction simulation

Many others...

But I thought we were talking about graphs...

	C	D	E	G
C	0	1.0	0	0
D	0.3	0.3	0.4	0
E	0	0.45	0.45	0.1
G	0	0	0.5	0.5

<http://setosa.io/markov>

POTD #20 Thu

<https://github.students.cs.ubc.ca/cpsc203-2019w-t1/potd20>

Describe any snags you run into:

1. Line ___: _____
2. Line ___: _____
3. Line ___: _____
4. Line ___: _____
5. Line ___: _____

ToDo for next class...

POTD: Continue every weekday! Submit to repo.

Reading: TLACS Ch 10 & 12 (lists and dictionaries)

References:

<https://brilliant.org/wiki/markov-chains/>

<https://medium.com/@eightlimbed/counting-on-pythons-defaultdict-b652204780bd>