CS 103000
Prof. Madeline Blount
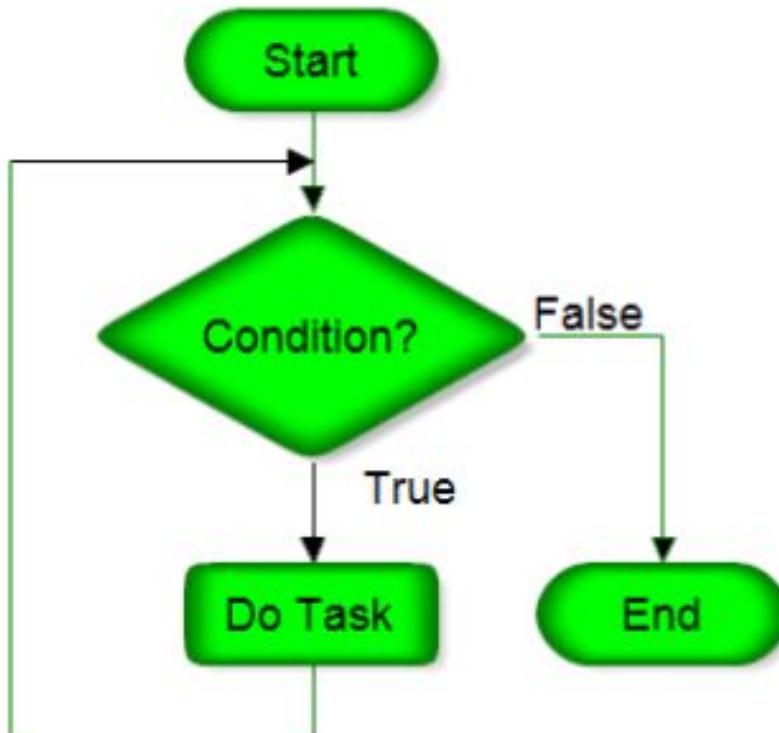
Week 4:
LOOPS (part 1)

Dall-E 2: cats learning C++ in the forest on '90's technology

While Loop

while (raining)

PROJECT EULER

800+ problems …

Multiples of 3 or 5

Problem 1

If we list all the natural numbers below 10 that are multiples of 3 or 5, we get 3, 5, 6 and 9. The sum of these multiples is 23.

Find the sum of all the multiples of 3 or 5 below 1000.
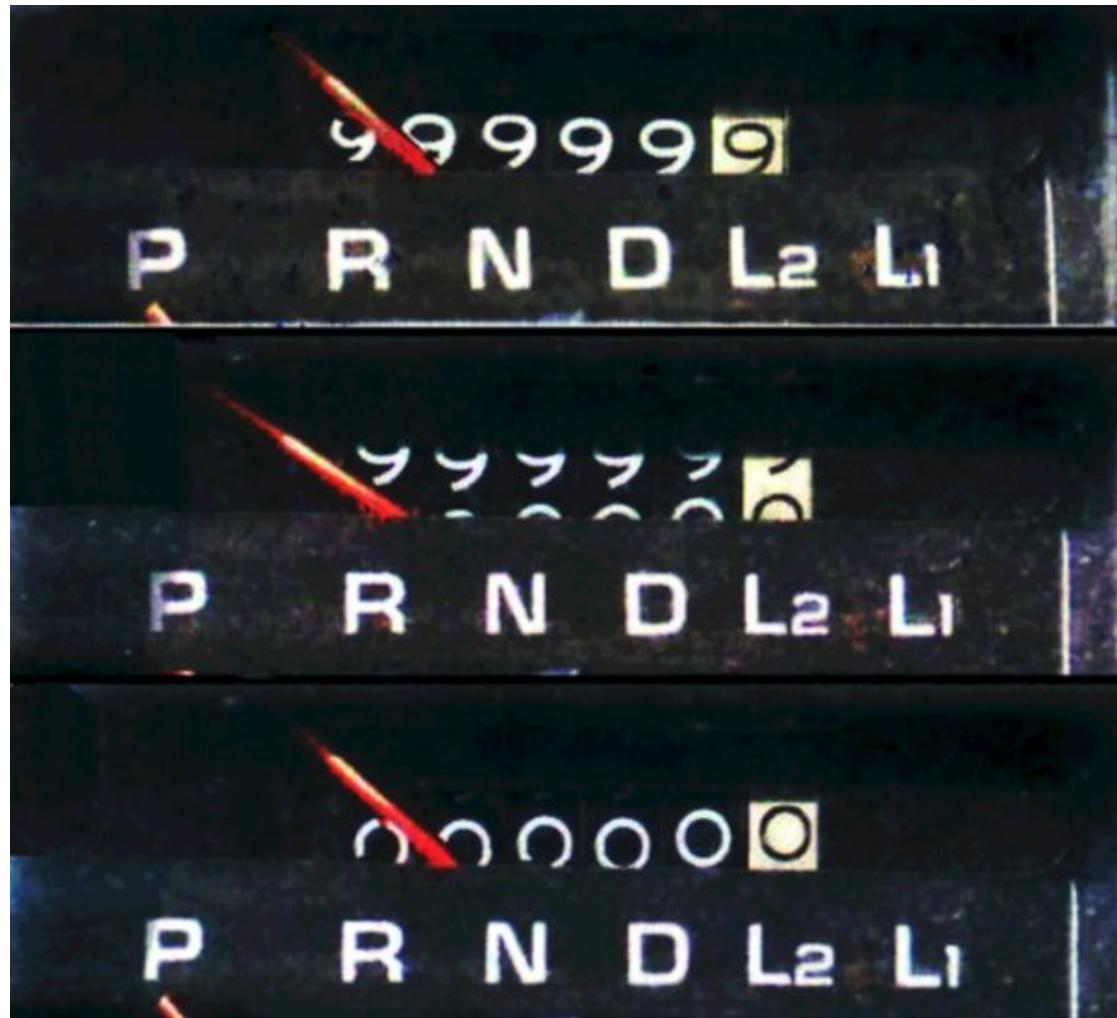
- Some integers! 1
- Multiples of 3 or 5
  - X % 3 == 0 // no remainder
  - X % 5 == 0 // no remainder
- Conditionals, branches if
- Loop? While loop
  - **SUM**
  - **Counter variable**

Problem 1: answer 233168

Data Type	Memory Size
bool	1 byte
char	1 byte
int	4 bytes
float	4 bytes
double	8 bytes
std::string	24 bytes

How many **years** are there in 2,147,483,647 **seconds**?

INTEGER OVERFLOW

INTEGER OVERFLOW

RUNNING OUT OF TIME!

Jan. 19th, 2038

32-bit integer seconds ++ after Jan. 1, 1970 (UNIX TIME)

what is RANDOM?

- Elusive - easier to describe what it *isn't*

- No discernable **pattern**

- Not **predictable** (Reveals itself in **sequence**)

- Not **deterministic** (the more factors we know, the more causality or pattern we can find, then it's not random)
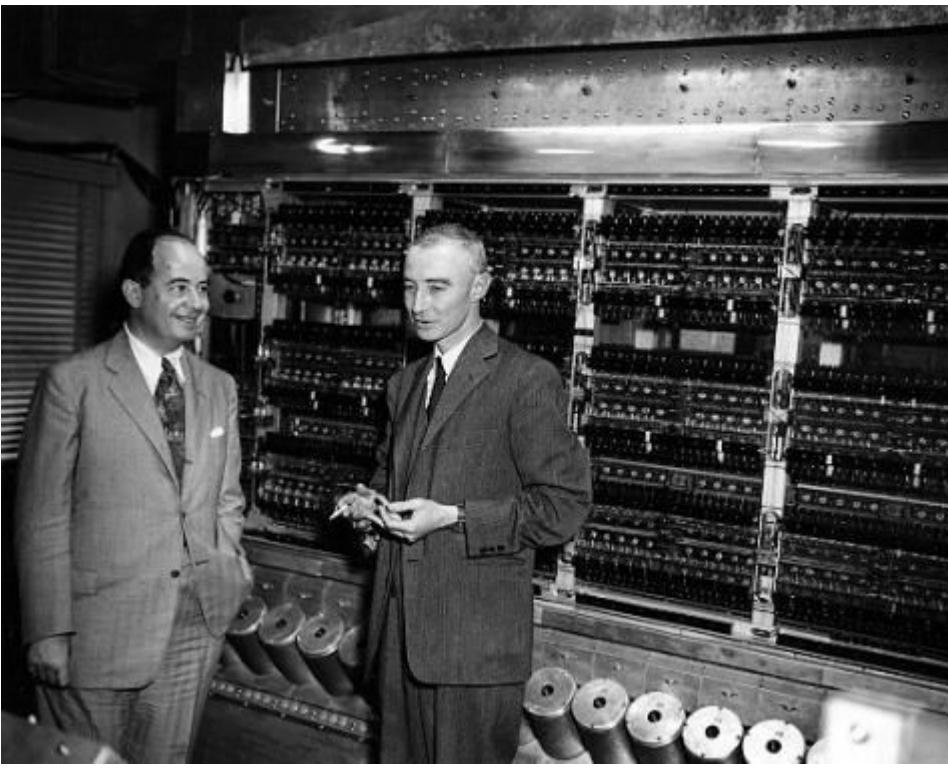
BUT …
computers ARE deterministic

SAME INPUTS -> SAME OUTPUTS
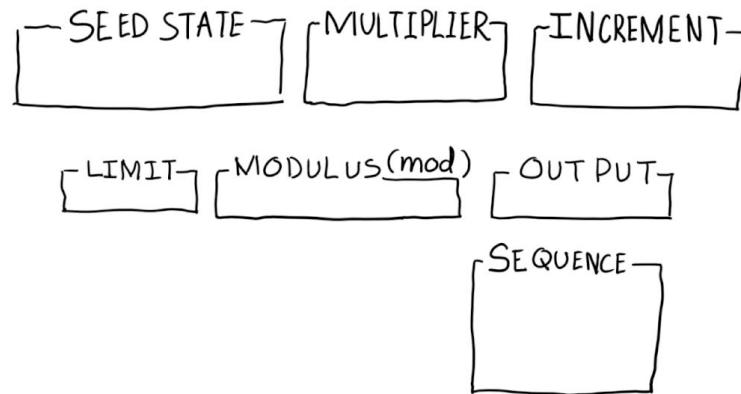
SNL

<u>John van Neumann</u> (here w/Robert Oppenheimer): "Anyone who considers arithmetical methods of producing random digits is, of course, in a state of sin."
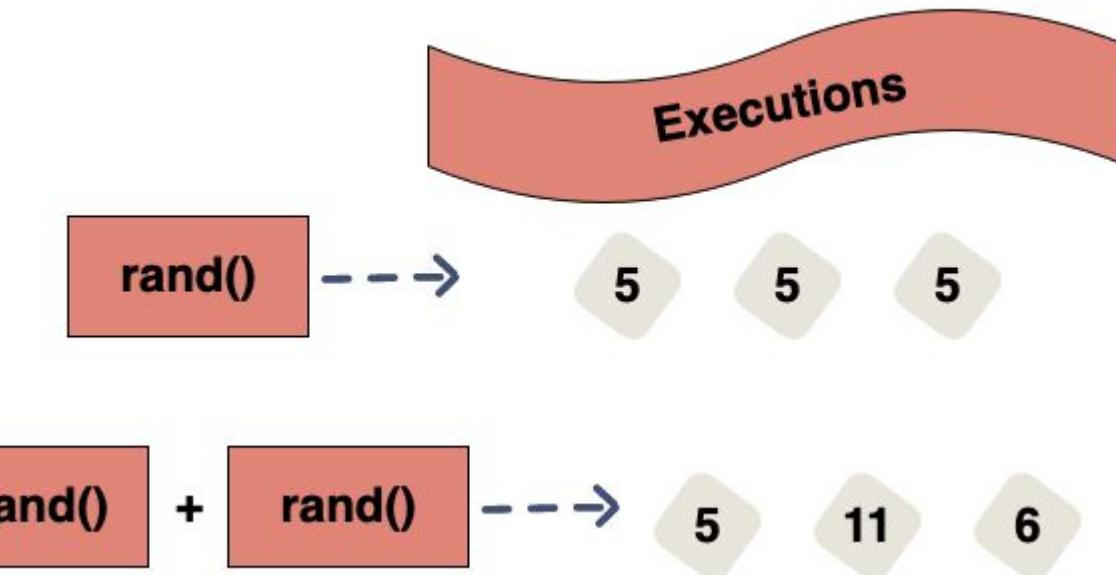
Pseudorandom! a **simulation**, random enough

- rand() = Linear Congruential Generator (LCG)

- x = ((a * x) + c) % m

- Next number based on the previous (**state**)

SEED STATE   MULTIPLIER   INCREMENT

LIMIT   MODULUS (mod)   OUTPUT

SEQUENCE

🌱🧑‍🌾🌽

`srand() = SEED`

RANDOMNESS FROM SEED ONLY; SAME SEED = SAME SEQUENCE!

Random integer between 0 and 1:

```
rand() % 2;
```

Random integer between 0 and 9:

```
rand() % 10;
```

Random integer between 0 and 10:

```
rand() % 11;
```

Random integer between 10 and 20:

```
rand() % 11 + 10;
```

- x = ((a * x) + c) % m

- if: a (multiplier) = 3

- if: c (incrementor) = 4

- if: m (modulo %) = 15

- if: x0 = 1

- Write out the first 6 numbers of this sequence.

COLOSSAL CAVE ADVENTURE
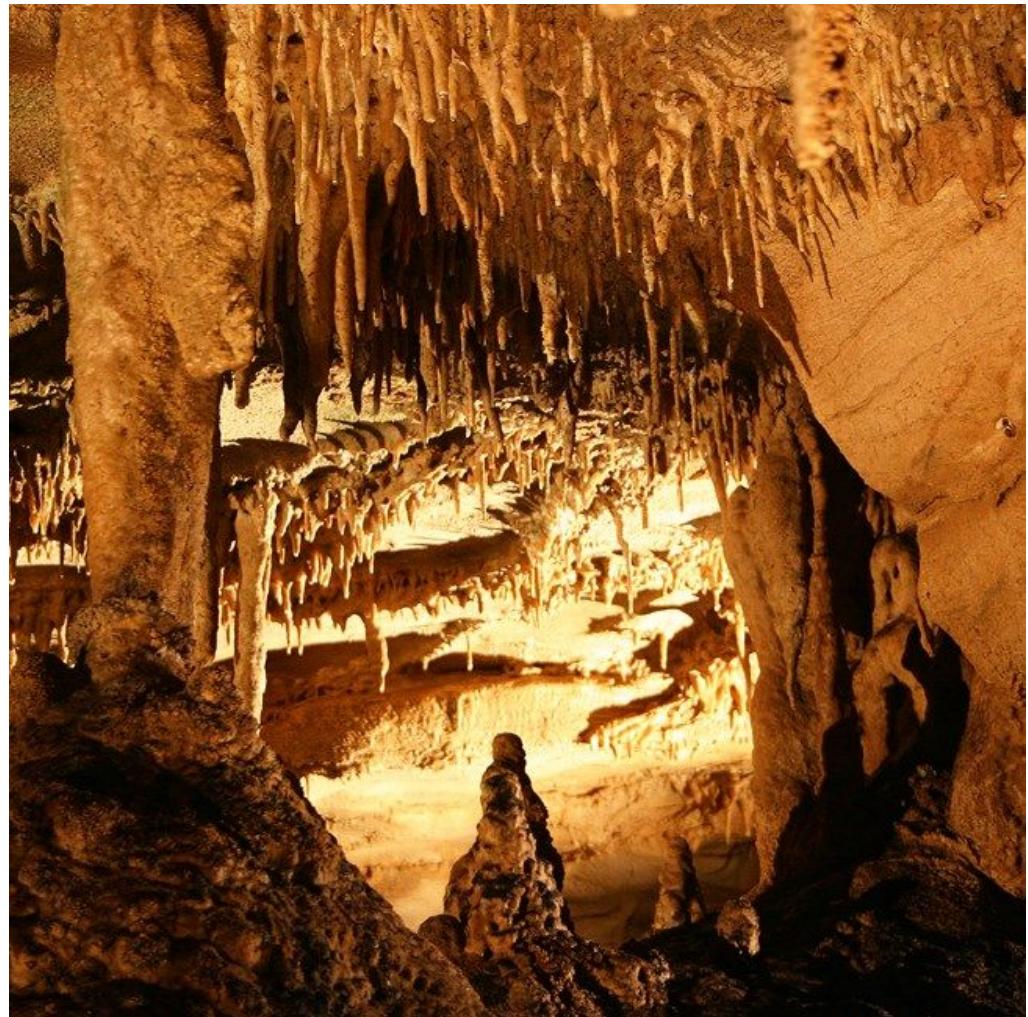
Will Crowther (1976)
Patricia Crowther
Don Woods (1977)
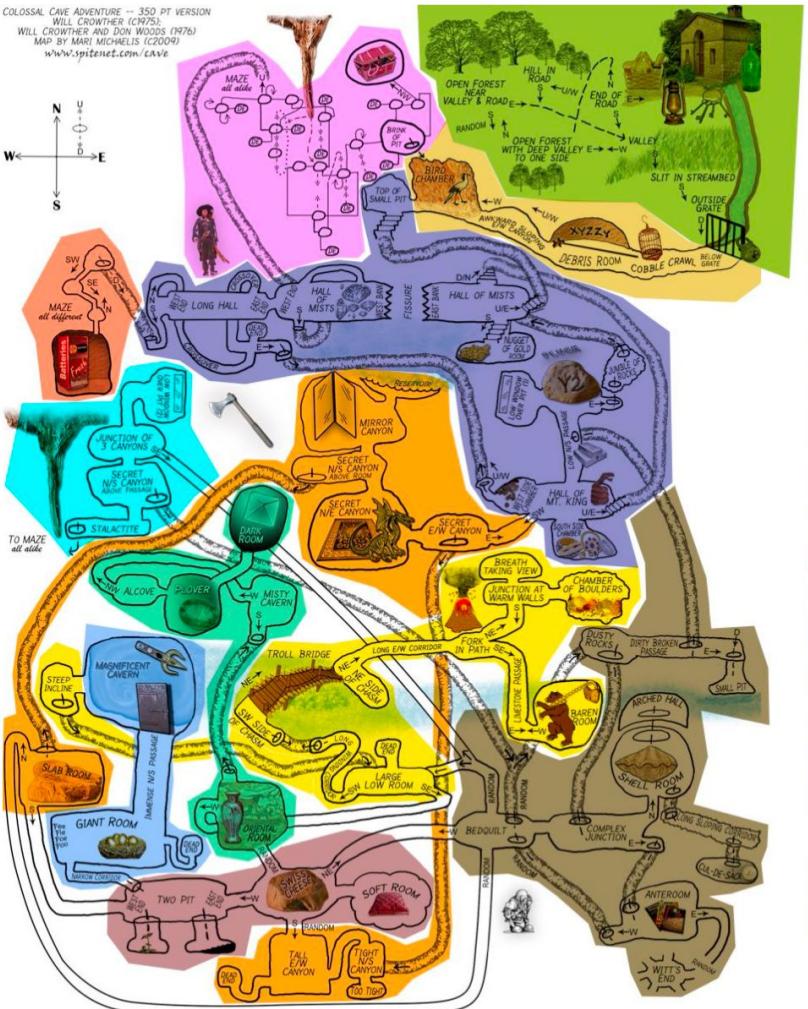
Mammoth Cave, Kentucky
Longest cave in the world

FORTRAN, 700 lines of code

COLOSSAL CAVE ADVENTURE -- 350 PT VERSION
WILL CROWTHER (C1975);
WILL CROWTHER AND DON WOODS (1976)
MAP BY MARI MICHAELIS (C2009)
www.spitenet.com/cave

N
U
W · D · E
S

MAZE all alike
BRINK OF PIT
TOP OF SMALL PIT
BIRD CHAMBER

OPEN FOREST NEAR VALLEY & ROAD
HILL IN ROAD
END OF ROAD
RANDOM
OPEN FOREST WITH DEEP VALLEY TO ONE SIDE
VALLEY
SLIT IN STREAMBED
OUTSIDE GRATE
BELOW GRATE

XYZZY
DEBRIS ROOM
COBBLE CRAWL

MAZE all different

LONG HALL
HALL OF MISTS
FISSURE
HALL OF MISTS
NUGGET OF GOLD ROOM
Y2

JUNCTION OF 3 CANYONS
SECRET N/S CANYON ABOVE PASSAGE
STALACTITE
TO MAZE all alike

MIRROR CANYON
SECRET N/S CANYON ABOVE ROOM
SECRET N/E CANYON
SECRET E/W CANYON
RESERVOIR
LOW N/E PASSAGE
HALL OF MT. KING
SOUTH SIDE CHAMBER

DARK ROOM
SW ALCOVE
PLOVER
W. MISTY CAVERN

BREATH TAKING VIEW
JUNCTION AT WARM WALLS
CHAMBER OF BOULDERS
FORK IN PATH
LONG E/W CORRIDOR
SIDE CHASM
DUSTY ROCKS
DIRTY BROKEN PASSAGE
SMALL PIT

MAGNIFICENT CAVERN
STEEP INCLINE
TROLL BRIDGE
SW SIDE CHASM
LIMESTONE PASSAGE
BARREN ROOM
ARCHED HALL
SHELL ROOM

SLAB ROOM
IMMENSE N/S PASSAGE
LARGE LOW ROOM
ORIENTAL ROOM
BEDQUILT
COMPLEX JUNCTION
LONG SLOPING CORRIDOR
CUL-DE-SAC

GIANT ROOM
TWO PIT
SPHERE
SOFT ROOM
ANTEROOM
RANDOM
WITT'S END

TALL E/W CANYON
TIGHT N/S CANYON
TOO TIGHT

WellhouseVR
CobbleCrawl
HallOfMists
SecretCanyon
TwoPit
GiantRoom
Orient
Junction
MazeAlike
MazeDifferent
Bedquilt
Troll