CS 103000
Prof. Madeline Blount

Week 4:
LOOPS (part 1) + RANDOMNESS

Attendance:
https://cs103-proton.glitch.me/

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

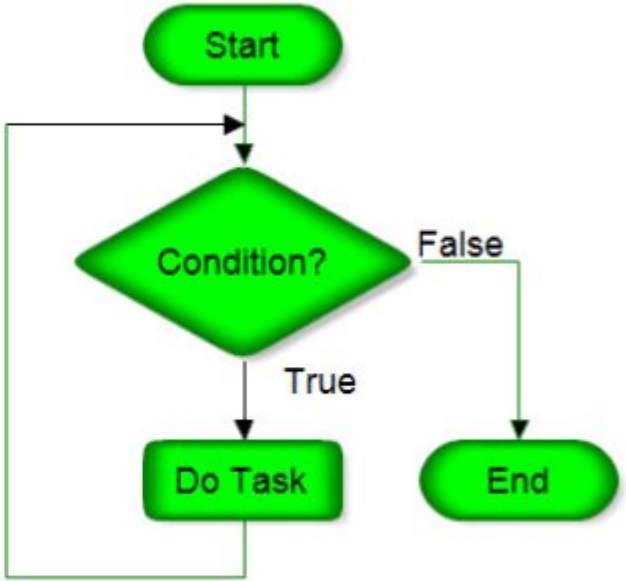
https://cs103-proton.glitch.me/

```
string passcode = "Proton";
string guess;
int attempts;
string suffix;

cout << "what's the password?" << endl;
cin >> guess;

if (guess == passcode) {
  cout << "that's correct, you can log in!" << endl;
  cout << "how many times did you have to guess?" << endl;
  cin >> attempts;
  if (attempts % 10 == 1) {
    suffix = "st";
  } else if (attempts % 10 == 2) {
    suffix = "nd";
  } else if (attempts % 10 == 3) {
    suffix = "rd";
  } else if (attempts % 10 ≥ 4) {
    suffix = "th";
  }
  cout << "cool, you guessed it on the " << attempts << suffix << " try."
       << endl;
} else if (guess == "proton") {
  cout << "you're close, remember case sensitive." << endl;
} else {
  cout << "THAT'S NOT THE PASSWORD" << endl;
}
```

While Loop




while (raining)

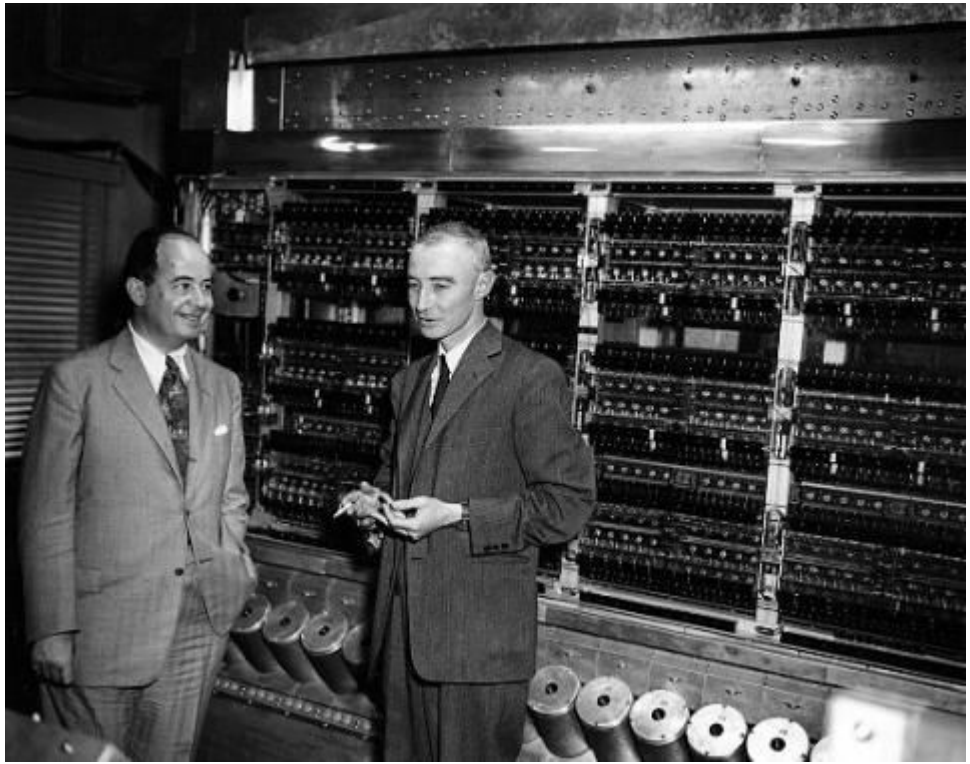
what is RANDOM?

- Elusive - easier to describe what it *isn't*
- No discernable **pattern**
- Not **predictable**
- Not **deterministic** (the more factors we know, the more causality we can find, then it's not random)

BUT …
computers ARE deterministic

SAME INPUTS -> SAME OUTPUTS

SNL

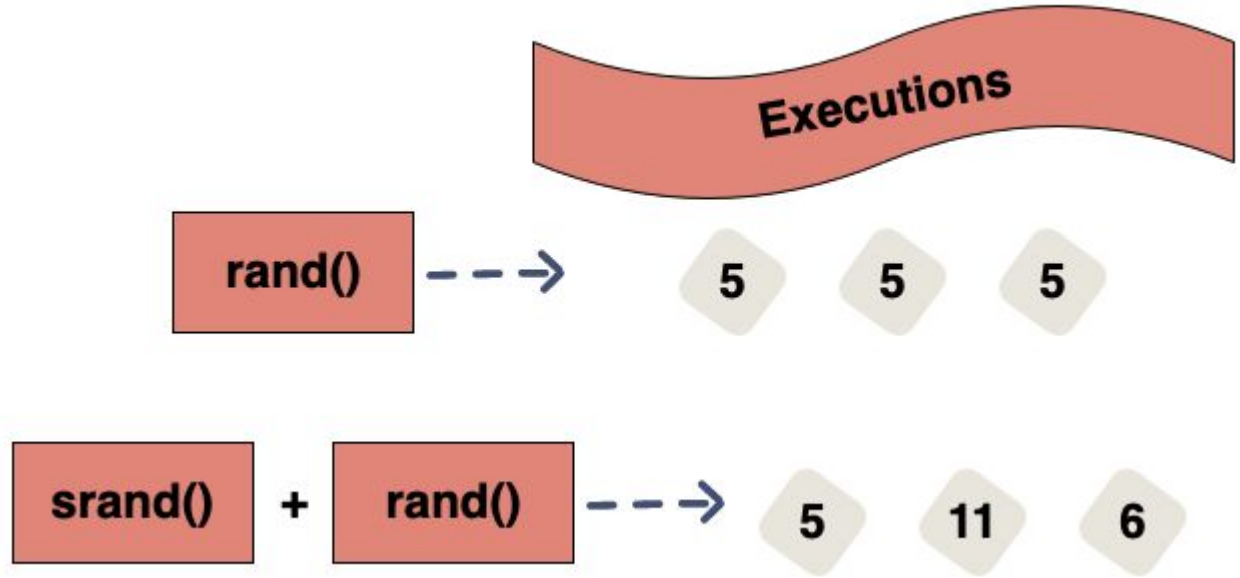


John van Neumann (here w/Robert Oppenheimer: “Anyone who considers arithmetical methods of producing random digits is, of course, in a state of sin.”

pseudorandom!

- rand() = Linear Congruential Generator (LCG)
- x = ((a * x) + c) % m
- Next number based on the previous (**state**)

`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;
```

pseudorandom!

- Deterministic (seed)
- Sequence starts to repeat (period)
- Bias, heading toward 0 or larger nums
- There are other random number generators that are better than rand()! But still pseudo
- There are some “real” random generators also, based on other “world” 🌍 inputs … (time between clicks, noise in radio, etc.)

pseudorandom!

- Mysterious: creating non-patterns out of patterns, manufacturing “fake” chaos from order
- Is there *any* randomness? Or is the universe a pattern that we don’t recognize yet?

PROJECT EULER

https://projecteuler.net/

800+ problems …

Project Euler.net

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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.

Problem 1: answer 233168