

CS 103000

Prof. Madeline Blount

Week 4:

LOOPS (part 1) +  
RANDOMNESS

Attendance:

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



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

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



The sample return capsule from NASA's OSIRIS-REx mission is seen shortly after touching down in the desert, Sunday, Sept. 24, 2023, at the Department of Defense's Utah Test and Training Range. The sample was collected from the asteroid Bennu in October 2020 by NASA's OSIRIS-REx spacecraft.

**Credits: NASA/Keegan Barber**

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*Victoria Thiem, system safety engineer from Lockheed Martin, checks the temperature of the actual size OSIRIS-REx's return capsule sample during the recovery rehearsal at Lockheed Martin's Waterton Canyon campus in Littleton, Colorado, on Tuesday, June 27th, 2023. Photo by Hyung Chang / The Denver Post*



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

## The OSIRIS-REx Laser Altimeter (OLA) Investigation and Instrument

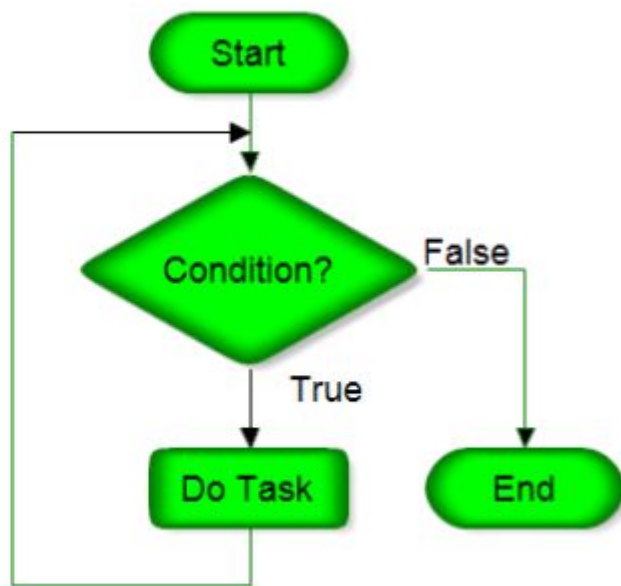
M.G. Daly · O.S. Barnouin · C.  
Dickinson · J. Seabrook · C.L. Johnson ·  
G. Cunningham · T. Haltigin · D.  
Gaudreau · C. Brunet · I. Aslam · A.  
Taylor · E.B. Bierhaus · W. Boynton ·  
M. Nolan · D.S. Lauretta

### 3.3 Software

OLA command and data handling functions are handled by a general purpose single-board computer. The Aitech S950 single-board computer runs at 400 MHz to reduce power consumption relative to the highest clock-speed model. It is running Wind River VxWorks 5.5 as an operating system. The software uses object-oriented design in C++.

[https://sbnarchive.psi.edu/pds4/orex/orex.ola/document/ola\\_inst\\_paper.pdf](https://sbnarchive.psi.edu/pds4/orex/orex.ola/document/ola_inst_paper.pdf),  
<https://github.com/DOI-USGS/ISIS3/tree/dev/isis/src/osirisrex/apps/ocams2isis>

## 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 or pattern we can find, then it's not random)

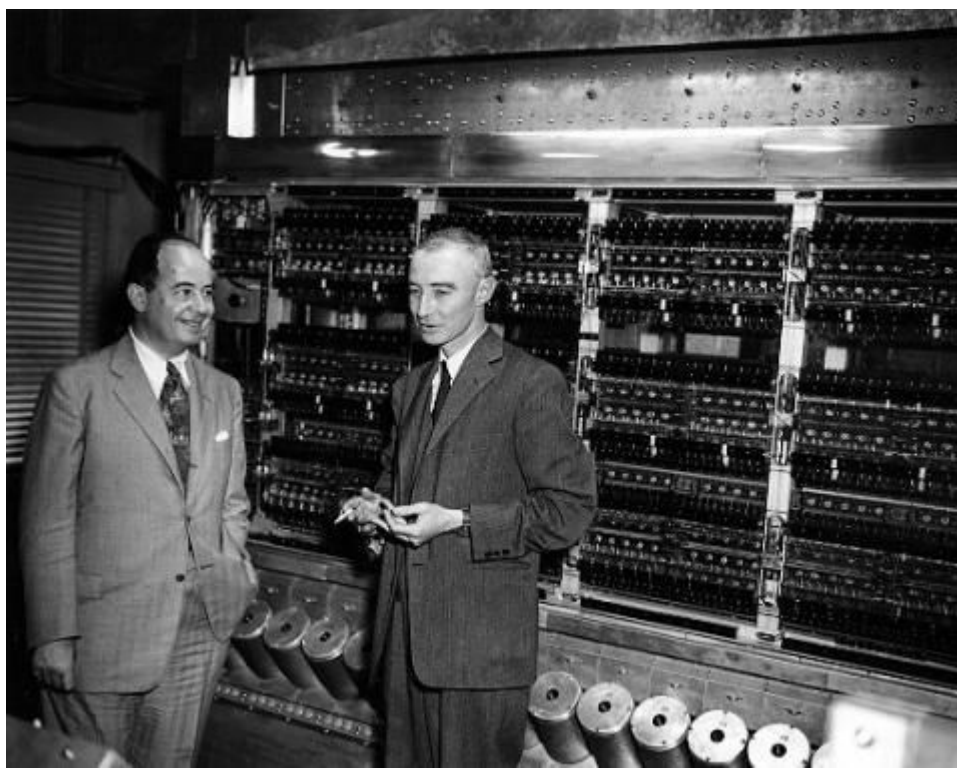
BUT ...

**computers ARE deterministic**

**SAME INPUTS -> SAME OUTPUTS**



SNL

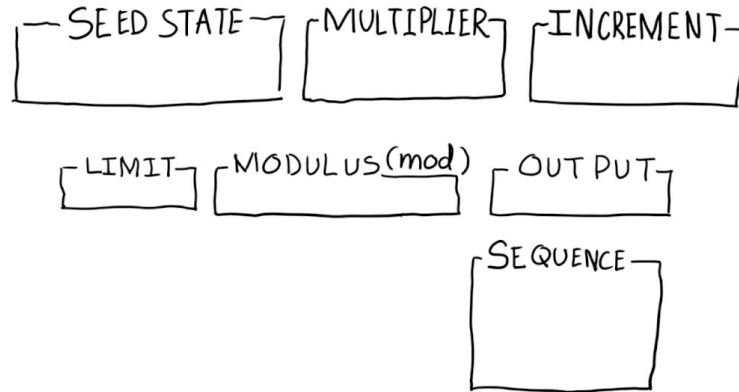


John von Neumann (here w/Robert Oppenheimer):  
"Anyone who considers arithmetical methods of  
producing random digits is, of course, in a  
state of sin."



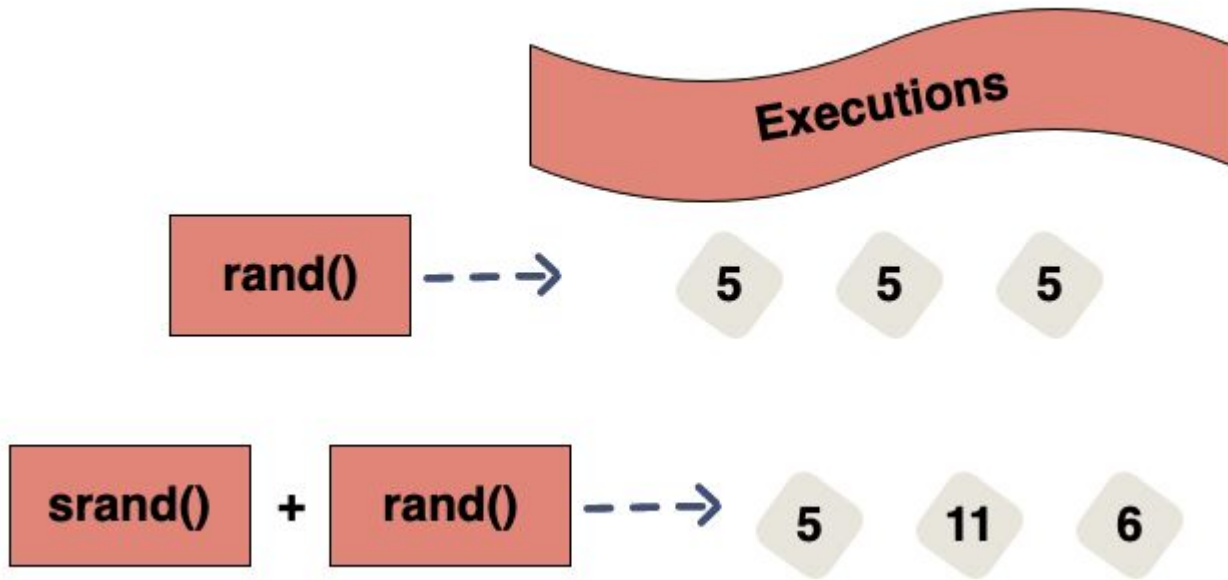
pseudorandom!

- `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;
```