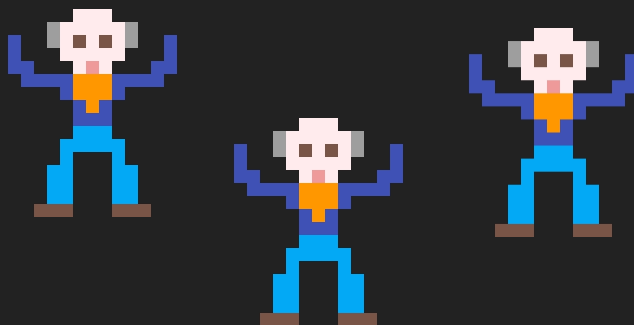


# Be Ready to Present Your Progress!



Let's Discuss!

Random Generation  
vs.  
Procedural Generation

# Let's Discuss!

Those of you who made “endless” runner prototypes:

Where there random or procedural or mixed?

# Random Generation

# Dungeons and Dragons

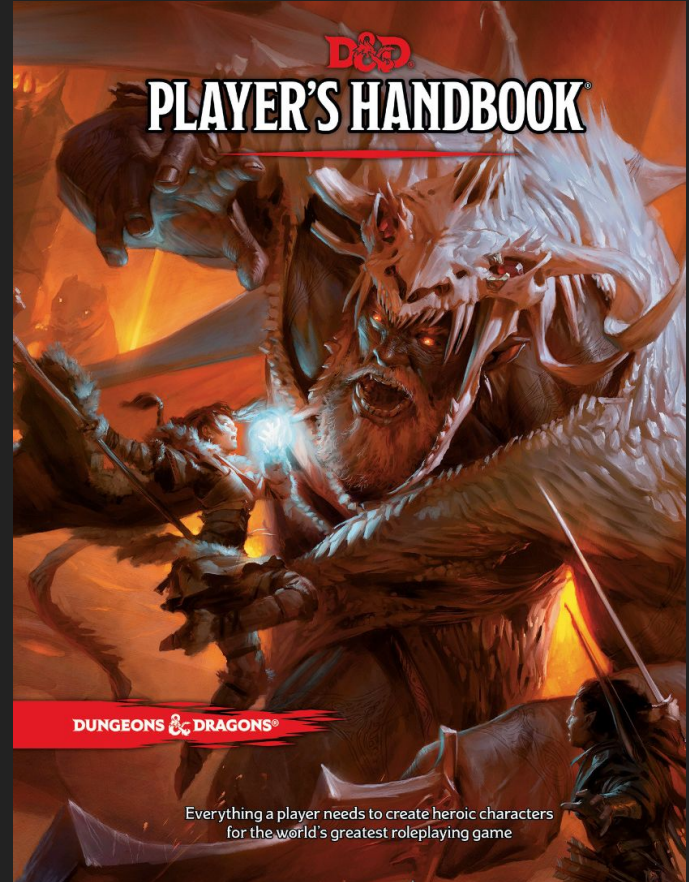
(random encounters)

# Dungeons and Dragons

Paper based game

Everything is in your head

Dice... lots and lots of dice!



**Illrigger Table III: Followers**

Dice roll	Type of follower
01-08	1-10 thieves of 1st level
09-14	1-8 thieves of 1st-2nd level
15-19	1-6 thieves of 1st-4th level
20-23	1-4 thieves of 2nd-5th level
24-26	1-2 thieves of 3rd-6th level
27-28	1 thief of 4th-7th level
29-31	1-4 assassins of 1st-2nd level
32	1 assassin of 3rd-6th level
33-35	1-6 magic-users of 1st level
36-37	1-4 magic-users of 1st-2nd level
38	1-2 magic-users of 2nd-5th level
39-40	1-2 illusionists of 1st-2nd level
41	1 illusionist of 2nd-4th level
42-46	1-6 clerics of 1st-4th level
47-49	1-3 clerics of 2nd-5th level
50-51	1-2 clerics of 4th-7th level
52	1 cleric of 5th-8th level
53	1-2 cloistered clerics <sup>1</sup> of 1st-4th level
54-61	4-40 0-level men-at-arms of 1-6 hp each
62-67	1-10 fighters of 1st level
68-72	1-8 fighters of 1st-4th level
73-76	1-6 fighters of 2nd-5th level
77-79	1-4 fighters of 3rd-6th level
80-81	1-2 fighters of 4th-7th level
82	1 cavalier of 1st-6th level
83-84	1 hellcat or hell hound
85	6-24 mites
86	1 penanggalan
87	20-200 duergar plus females and young
88	20-200 orcs plus females and young
89	30-300 goblins plus females and young
90	10-100 hobgoblins plus females and young
91	1 blue dragon
92	1 ghost
93	1 spectre
94	1 wight
95	1 wraith
96	2 manticores
97	1-8 fire giants plus females and young
98	1-4 NPCs of any lawful evil class or subclass
99	special (see subtable on next page)

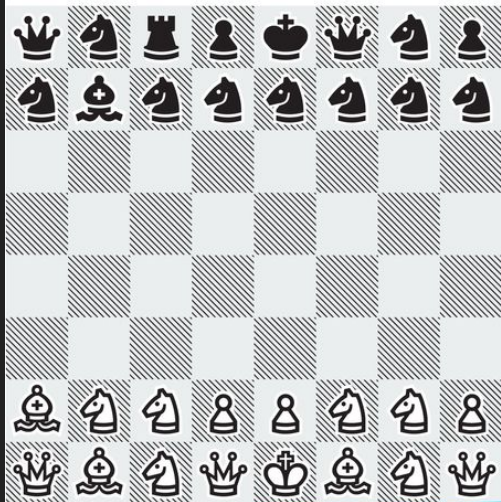
d100	Encounter
18-20	1d3 winged kobolds with 1d6 kobolds
21-25	The partially eaten carcass of a mammoth, from which 1d4 weeks of rations can be harvested
26-29	2d8 hunters (tribal warriors)
30-35	1 half-ogre
36-40	Single-file tracks in the snow that stop abruptly
41-45	1d3 ice mephits
46-50	1 brown bear
51-53	1d6 + 1 orcs
54-55	1 polar bear
56-57	1d6 scouts
58-60	1 saber-toothed tiger
61-65	A frozen pond with a jagged hole in the ice that appears recently made
66-68	1 berserker
69-70	1 ogre
71-72	1 griffon
73-75	1 druid
76-80	3d4 refugees (commoners) fleeing from orcs
81	1d3 veterans
82	1d4 orogs
83	2 brown bears
84	1 orc Eye of Gruumsh with 2d8 orcs
85	1d3 winter wolves
86-87	1d4 yetis
88	1 half-ogre
89	1d3 manticores
90	1 bandit captain with 2d6 bandits
91	1 revenant
92-93	1 troll
94-95	1 werebear
96-97	1 young remorphaz
98	1 mammoth
99	1 young white dragon
00	1 frost giant

# Really Bad Chess



# really bad chess

chess with totally random pieces



For everyone who quit playing chess  
(and everyone who loves playing chess)

# ranked

rank: 65



But this board...  
looks a little tougher.

# Cross Platform Random Number Generator

## Quintet

Example Json:

```
"title": "Asteroid Field",  
"locationType": "neutral",  
"respawn": true,  
"universeSeed": 2021
```

Just need to send 1 number  
to other players to  
generate entire scenes!



## Random Seed (multiplatform)

```
// How to use CustomRandom.cs (in class resources folder)
```

```
customRandom = new CustomRandom(seed);
```

```
whatever = RandomRange(1, 10);
```

```
int RandomRange(int min, int max)
{
    var r = customRandom.NextDouble();
    var range = (max - min); // exclusive
    var rand = (int)((double)range * r);
    return rand + min;
}
```

# Procedural Generation

# No Man's Sky

"18 quintillion planets"

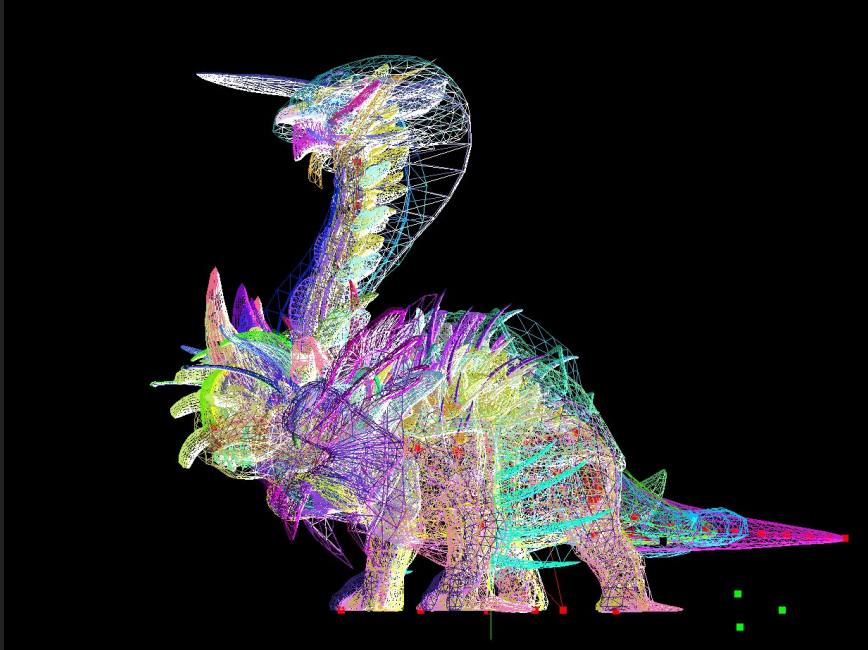
(sounds like  $2^{64}$  to me)

Trivia: This datatype in C is called a "unsigned long long"



## CS 6553/4553: GAME DESIGN



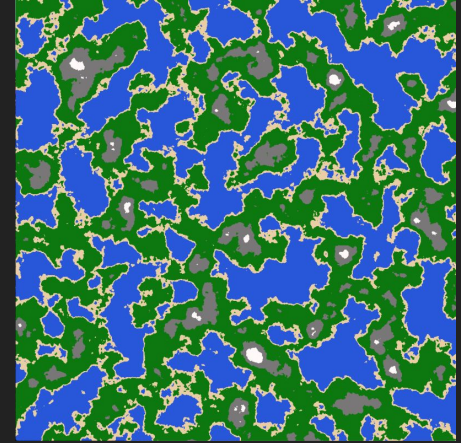
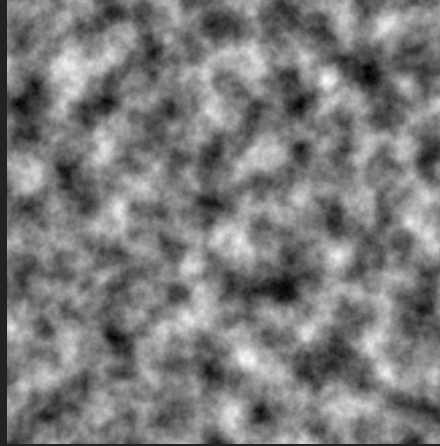




# Minecraft

(perlin noise)





“Perlin noise is a type of gradient noise developed by Ken Perlin in 1983 as a result of his frustration with the “machine-like” look of computer graphics at the time.”

- [https://en.wikipedia.org/wiki/Perlin\\_noise](https://en.wikipedia.org/wiki/Perlin_noise)

<https://www.youtube.com/watch?v=IKB1hWWedMk>

<https://www.youtube.com/watch?v=bG0uEXV6aHQ>

<https://catlikecoding.com/unity/tutorials/noise-derivatives/>

# Diablo 3

(other Diablo games did this too)

## Diablo 3



# Diablo 3





# Diablo 3



# Spelunky



# Spelunky



## Spelunky

New Levels Every Time

Based on “Rooms”

Lots of Replayability



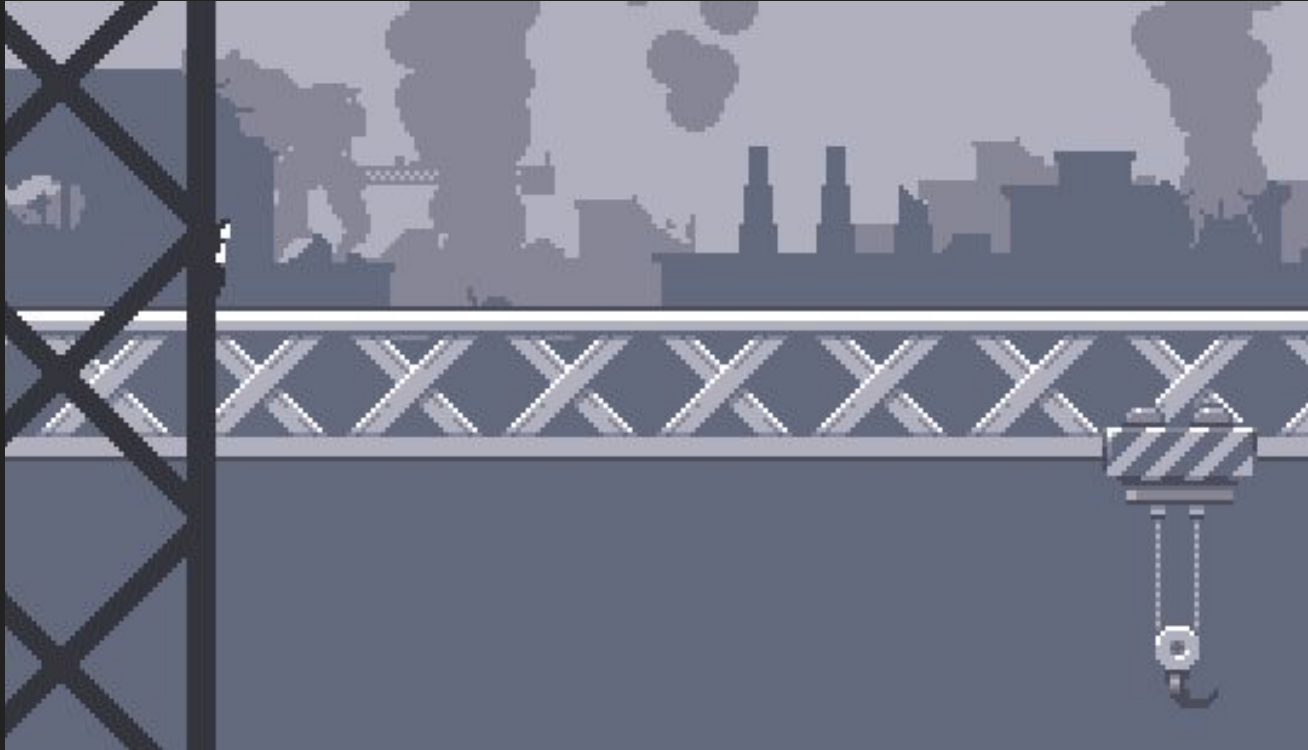
# Level Generation in Spelunky

<http://tinysubversions.com/spelunkyGen/>

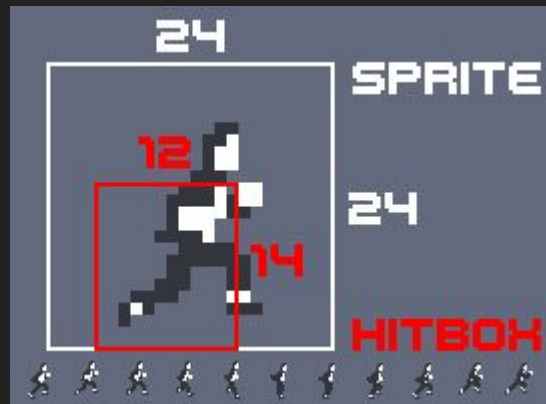
# Canabalt

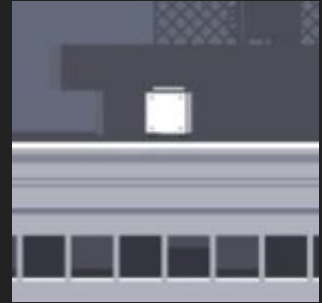
(endless runner)

## Canabalt



## Canabalt





Character at far left to give player time to react.

Calculations are done to make sure all jumps are possible!

Obstacles on rooftops.



# Keep Going!

Continue working on your group project!

