Sp18 CS 61B Discussion 8

Welcome!

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Announcements

- Lab: Mandatory Project 2 checkoff!
- MT2 is close than it appears!
- Be on the lookout for HW2/HW3...

Quiz Instructions

- If you haven’t yet, please also **neatly** put your email address **outside the name box** if you want to be emailed!
- Bubble number **41**.

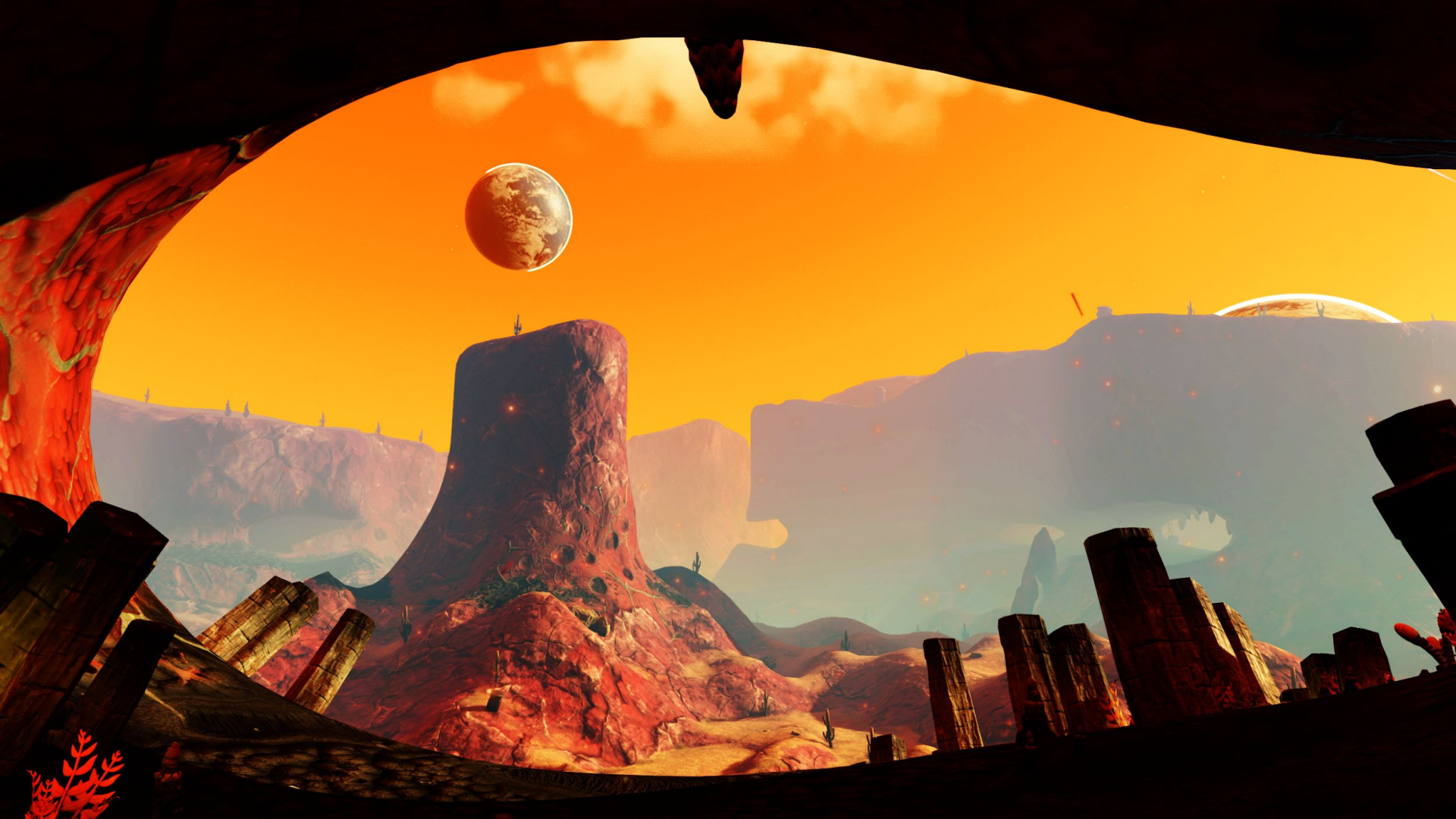
Aside

Procedural Generation: A History

- **Rogue (1980)** and **Elite (1984)**
  - Pioneers of 2D PCG
- **Dwarf Fortress (2006)** and **Spore (2008)**
  - Considered cutting edge 2D PCG
- **Minecraft (2011)**: First 3D PCG (but in block-form)

No Man’s Sky (2016)

- A beautiful game (realistic texture) all in PCG
  - 256 procedurally generated universes, each with ~17 quintillion distinct planets
  - Each planet’s landscape automatically generated
  - Flora and fauna completely generated



Simple Terrain Generation Algorithm

- Called the **diamond-square algorithm**.
- Recursively divides a square into smaller squares with new vertices offset by a random height.
- At each recursion level, maximum offset shrinks.
- https://www.youtube.com/watch?v=9HJKrctqIJI

More Topics

- Perlin noise algorithm (realistic landscapes)
  - https://en.wikipedia.org/wiki/Perlin_noise
- Voronoi diagrams
- Take lots of stats classes! (Distributions are important)

Moral of the Story

- **There’s more to CS than we can ever teach you!**

References

- A PCG community:
  - https://www.reddit.com/r/proceduralgeneration/

Asymptotics

Notation: Big O, Big Omega, Big Theta

- Goal: Look at program complexity for large input
- Notations:
  - Big O - bounds above (often used for worst case)
  - Big Omega - bounds below (often used for best case)
  - Big Theta - bounds above and below (both best and worst case)

O (Big O)

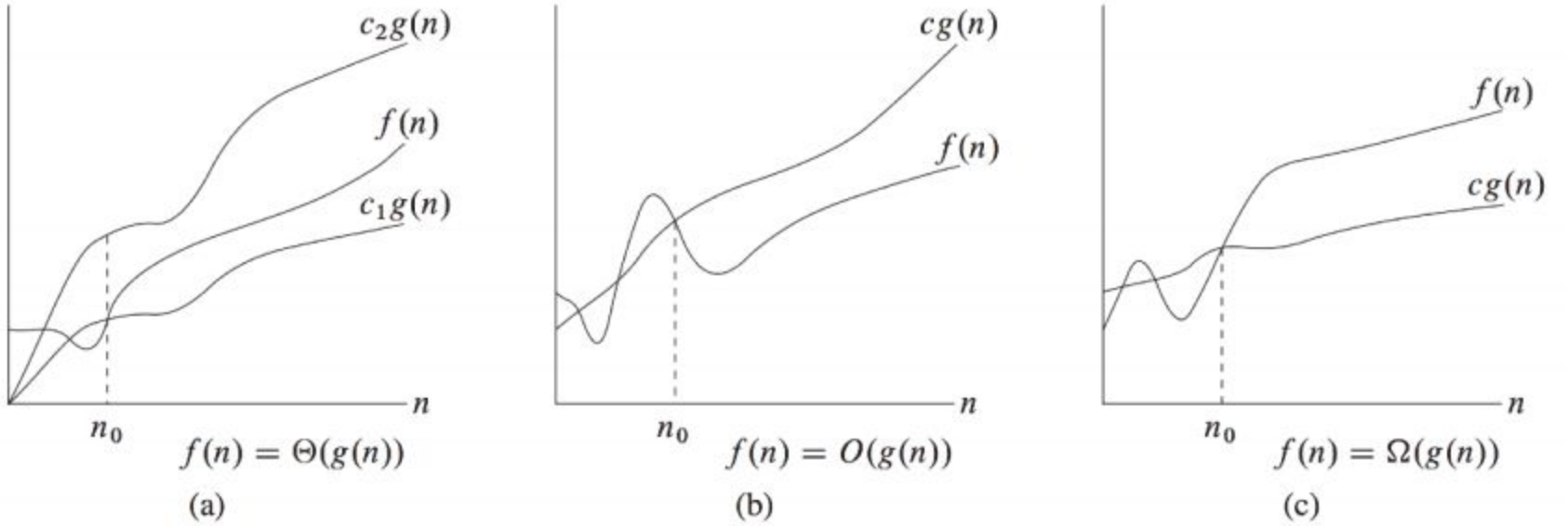
- Let f(n) and g(n) be positive real numbers on inputs of size n
- $f \in O(g)$ if there is a constant $c > 0$ s.t. $f(n) <= c\ g(n)$
- Upper bounded by g(n) when n gets significantly large.
- Bound does not have to be tight.

Ω (Big Omega)

- Let f(n) and g(n) be positive real numbers on inputs of size n
- $f \in O(g)$ if there is a constant $c > 0$ s.t. $f(n) >= c\ g(n)$
- Lower bounded by g(n) when n gets significantly large.
- Bound does not have to be tight.

Θ (Big Theta)

- Let f(n) and g(n) be positive real numbers on inputs of size n
- f ∈ Θ(g) if there is a constant c1 > 0 and c2 > 0 s.t.
    - C1 g(n) <= f(n) <= c2 g(n) for all c1 <= c2
- Tightly bounded by g(n) when n gets significantly large.
- • f ∈ Ω(g) and f ∈ O(g)



Introduction to Algorithms, Cormen, Leiserson, Rivest, Stein

Onto Discussion