Week 4 - Friday

COMP 4500

Last time

- What did we talk about last time?
- Scheduling to minimize lateness
- Dijkstra's algorithm

Questions?

Review

Big Oh

- Order the following functions by rate of growth:
  - $(\sqrt{2})^{\log n}$
  - n^2
  - $n!$
  - $(\log n)!$
  - $\left(\frac{3}{2}\right)^n$
  - n^3
  - $(\log n)^2$
  - $\log(n!)$
  - 2^{2^n}
  - $\log(\log n)$
  - $n \cdot 2^n$
  - $n^{\log(\log n)}$
  - $\log n$
  - 1
  - $2^{\log n}$
  - $(\log n)^{\log n}$
  - $4^{\log n}$
  - $(n+1)!$
  - $\sqrt{\log n}$
  - n
  - 2^n
  - $n \log n$

Big Oh

- Determine the running time of various loops
- Example:

```
int counter = 0;
for(int i = 0; i < n*n; ++i)
   for(j = 1; j <= i; ++j)
       counter++;
```

Graphs

- Know basic definitions of graphs
  - Nodes
  - Edges
  - Directed vs. undirected
  - Adjacency matrix vs. adjacency lists
  - Trees
  - Connected
  - Strongly connected

Graph algorithms to know

- BFS
- DFS
- Determining bipartiteness
- Find connected components
- Find strongly connected components
- Topological sort

Example proof

- For all $\boldsymbol{n} \in \mathbb{Z}$, if $\boldsymbol{n}^3 + 5$ is odd, then $\boldsymbol{n}$ is even.
- **Hint:** Try a proof by contradiction.

Example proof

- Prove that, for all integers $\boldsymbol{n} \geq 2$,

$$\sum_{i=1}^{n-1} i(i+1) = \frac{n(n-1)(n+1)}{3}$$

- **Hint:** Try a proof by induction.

Example proof

- Prove that, for all integers $n \geq 1$,

$$\frac{\sum_{i=1}^{n} 2i-1}{\sum_{i=1}^{n} 2n+2i-1} = \frac{1}{3}$$

- **Hint:** Try a proof by induction.

Example proof

- Prove that a graph with two or more nodes where each node has a degree of $n/2$ or higher must be connected.
- **Hint:** Try a proof by contradiction.

Upcoming

Next time…

- Exam 1!

Reminders

- **Finish Assignment 2**
  - **Due tonight before midnight**
- Review chapters 1 through 3