

## Discussion 2

Your Name: \_\_\_\_\_

Collaborators: \_\_\_\_\_

## Discussion

You will be randomly assigned groups to work on these problems in discussion section. List your group members on your worksheet and turn it in at the end of class.

**Problem 1. Asymptotics.** Assume you have functions  $f(n), g(n)$  such that  $f(n) = \Theta(g(n))$ . For each of the following statements, decide whether you think it is true or false and give a proof or counterexample.

1.  $2^{f(n)} = \Theta(2^{g(n)})$
2.  $f(n)^2 = \mathcal{O}(g(n)^2)$ .
3.  $f(n)^2 = \Theta(g(n)^2)$  (argue what else you need to show in addition to part b to prove or disprove it)

**Problem 2. Asymptotics.** Take the following list of functions and arrange them in ascending order of growth rate. That is, if function  $g(n)$  immediately follows function  $f(n)$  in your list then it should be the case that  $f(n)$  is  $\mathcal{O}(g(n))$ .

$$f_1(n) = 10^n$$

$$f_2(n) = n^{1/3}$$

$$f_3(n) = n^n$$

$$f_4(n) = \log_2 n$$

$$f_5(n) = 2^{\sqrt{\log_2 n}}$$

**Problem 3. Graphs.** The degree of node  $v$  in a graph is the number of edges incident to  $v$  (equivalently, the number of neighbors of  $v$ ). Let  $G$  be a connected undirected graph where every node has degree two or more. Prove that  $G$  has a cycle.