ECE368 Fall 2016 Homework #1

IMPORTANT:

- Do NOT leave your name or Purdue ID on this homework.
- Write your homework security number at the TOP of EACH page.

Read and sign the ***Academic Honesty Statement*** that follows:

"In signing this statement, I hereby certify that the work on this exercise is my own and that I have not copied the work of any other student while completing it. I understand that, if I fail to honor this agreement, I will receive a score of zero for this exercise and will be subject to further disciplinary action."

`Homework security number:`

Please acknowledge any people who have helped you with this homework.

Question	Credits
1	
2	
3	
4	

1. (30 points) For each function $f(n)$ and time t in the following table, determine the largest size n of a problem that can be solved in time t, assuming that the algorithm to solve the problem takes $f(n)$ microseconds. You might want to write a small program or script to help you with the calculations.

$f(n)$	t						
	1 second	1 minute	1 hour	1 day	1 month	1 year	1 century
$\log_2 n$							
$\sqrt{n}$							
n							
$n \log_2 n$							
n^2							
n^3							
2^n							
$n!$							

2. (30 points) Rank the following functions by order of growth, i.e., $g_i = \Omega(g_{i+1})$ (Note: look carefully at the equation above and give the correct order):

- n^2
- $n!$
- n^3
- $(\log_2 n)^2$
- $\log_2(n!)$
- $n2^n$
- $2^{\log_2 n}$
- $n^{1/\log_2 n}$

Justify your answer.

3. (20 points) Is $2^{(n+1)} = O(2^n)$? Is $2^{2n} = O(2^n)$? Prove your answer.

4. (20 points) Prove the following theorem:

For any two functions $f(n)$ and $g(n)$, we have $f(n) = \Theta(g(n))$ if and only if $f(n) = O(g(n))$ and $f(n) = \Omega(g(n))$.