CSE 780 Homework 1

Due Friday, October 3 by class time

1. Order the following function by asymptotic dominance. That is, produce a permutation $f_1(n), f_2(n), \ldots$ such that $f_i = O(f_{i+1})$.

   (a) $f(n) = n! * n^2$
   Hint: use Stirling's formula, $n! = \sqrt{2\pi n}\,(\frac{n}{e})^n \left(1 + \Theta\left(\frac{1}{n}\right)\right)$.

   (b) $f(n) = 2^{23}$

   (c) $f(n) = 1/n^2$

   (d) $f(n) = 4^{\sqrt{n}}$

   (e) $f(n) = n^{2n}$

   (f) $f(n) = \log_2 \log_2(n^5 + n^2)$

   (g) $f(n) = 19n^{1.5} + 3n^{2.1} + \sqrt{n}$

   (h) $f(n) = 27 \log_7(n) + \sqrt{\log_2(n)}$

   (i) $f(n) = (\log_2 n)^3$

   (j) $f(n) = 5^{\log_2 n} + \sqrt{n}$

   (k) $f(n) = 2^{(2^n)}$

2. Prove or disprove the following statement: If $f(n) = \Theta(n^2)$, then $f(n)$ is asymptotically monotonically nondecreasing (i.e., $f(n) \leq f(n+1)$ for all sufficiently large integers n). (To disprove a statement, you need to give a specific counterexample.)

3. Prove or disprove the following statement: If $f(n) = O(g(n))$, then $2^{f(n)} = O(2^{g(n)})$. (To disprove a statement, you need to give a specific counterexample.)

4. How many dollar signs (\$'s) will the following procedures print? Give your answer, in Θ notation, as a function of n. Justify your answer.

```
Procedure dollar(n)
    j ← 1
    while j < n do
        j ← j + j
        k ← 2
        while k < n do
            k ← k * k
            print($)
```

End of Homework 1: there were a total of four questions.