Quiz 3

EECS 203

Spring 2015

Name (Print): ____

uniqname (Print): ____

Instructions. You have 25 minutes to complete this quiz. You may not use any sources of information, including electronic devices, textbooks, or notes. Leave at least one seat between yourself and other students. Please write clearly. If we cannot read your writing, it will not be graded.

Honor Code. This course operates under the rules of the College of Engineering Honor Code. Your signature endorses the pledge below. After you finish your exam, please sign on the line below:

I have neither given nor received aid on this examination, nor have I concealed any violations of the Honor Code.

____

Page #	**Points**
1	/18
2	/12
Total	**/30**

1) For each of the following, circle *each statement that is true (that could be zero, one, or more for each question).* **[18 points]**

Each problem is worth 3 points and you only get the points if you circle all of the correct answers.

a) $X^3+12X^2\log(X)+X$ is:

$\Theta(X^4)$ **$O(X^4)$** ✓ **$\Omega(X^4)$** **$\Theta(X^3)$** ✓ **$\Omega(X^3)$** ✓

b) Consider the following pseudo code:

```
for (i:=1 to n)
   for (j:= 1 to i)
     if(A[i]>A[j])
          swap(A[i],A[j]); //Takes Θ(1) time.
```

This algorithm has a run time of

$\Theta(i^2)$ **$\Theta(n^2)$** ✓ **$\Theta(i^3)$** **$\Theta(n^3)$** **$\Theta(i^2+1)$**

c) The $\sum_{k=1}^{n} k^2$ is

$\Theta(n^2)$ **$\Theta(n^3)$** ✓ **$\Theta(n^4)$** **$O(n^3)$** ✓ **$\Omega(n^2)$** ✓

d) If A and B are both countably infinite sets, then A-B could be

Countably infinite ✓ **Uncountably infinite** **Finite** ✓

e) If A and B are both **un**countably infinite sets, then A∩B could be

Countably infinite ✓ **Uncountably infinite** ✓ **Finite** ✓

f) If A and B are both countably infinite sets, then A∪B could be

Countably infinite ✓ **Uncountably infinite** **Finite**

2) Provide answers for the following **[6 points, 3 points each. Partial credit will be rare.]**

a) Compute (101*103*67*81) mod 20. Show your work.

101 mod 20 == 1 mod 20

103 mod 20 == 3 mod 20

101*103*67*81 == 1*3*7*1 mod 20 == 21 mod 20

67 mod 20 == 7 mod 20

21 mod 20 == 1 mod 20

81 mod 20 == 1 mod 20

b) Convert 1001001101_2 to base 16.

24D

3) Prove or disprove that if n is an integer greater than 1 such that 5 does not divide n then (n^4 mod 5)=1. **[6 points]** (Actual question: n^2 mod 5 is either 1 or 4)

For all n such that 5 does not divide n, n mod 5 == 1 or n mod 5 == 2 or n mod 5 == 3 or n mod 5 == 2 or n mod 5 == 3 or n mod 5 == 4.

Since we have n^2 mod 5 == (n mod 5)*(n mod 5) mod 5,

if n mod 5 == 1, n^2 mod 5 == 1 mod 5,

if n mod 5 == 2, n^2 mod 5 == 4 mod 5,

if n mod 5 == 3, n^2 mod 5 == 9 mod 5 == 4 mod 5

if n mod 5 == 4, n^2 mod 5 == 16 mod 5 == 1 mod 5

In all of these 4 cases, the statement holds. Since all n fit into one of these statements, the theorem is proven for all n.