Name:

Spring 2017 Math 245 Exam 3

Please read the following directions:
Please write legibly, with plenty of white space. Please print your name on the designated line, similarly to your quizzes (last name(s) in ALL CAPS). Please fit your answers in the designated areas. To get credit, you must also show adequate work to justify your answers. If unsure, show the work. All problems are worth 5-10 points. The use of notes, calculators, or other materials on this exam is strictly prohibited. This exam will begin at 12:40 and will last at most 60 minutes; pace yourself accordingly. Please leave **only** at one of the designated times: 1:00pm, 1:20pm, or 1:40pm. At all other times please stay in your seat (emergencies excepted), to ensure a quiet test environment for others. Good luck!

Problem	Min Score	Your Score	Max Score
1.	5		10
2.	5		10
3.	5		10
4.	5		10
5.	5		10
6.	5		10
7.	5		10
8.	5		10
9.	5		10
10.	5		10
Exam Total:	50		100
Quiz Ave:	50		100
Overall:	50		100

Problem 1. Carefully define the following terms:

a. recurrence

b. order of a recurrence

c. big Theta (Θ)

d. (set) equality

Problem 2. Carefully define the following terms:

a. Associativity of $\cup$ Theorem

b. De Morgan's Law for Sets Theorem

c. power set

d. Cantor's Theorem

Problem 3. Let S, T be sets. Prove that $S \setminus T \subseteq S$.

Problem 4. Prove that $n + 100 = O(n)$. Note that the Classification Theorem does not help.

Problem 5. Suppose that an algorithm has runtime specified by the recurrence relation $T_n = 5T_{n/2} + n^2$. Determine what, if anything, the Master Theorem tells us.

Problem 6. Let S, T be sets. Prove that $S \times T$ is equicardinal with $T \times S$.

Problem 7. Set $R = \{1, 2, 3, 4, 5\}, S = \{4, 5, 6, 7\}, U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$. Calculate $|(R^c \cup S)^c \cup (S^c \setminus R)^c|$. Be sure to justify your answer.

Problem 8. Solve the recurrence defined as $a_0 = a_1 = 2$, $a_n = 4a_{n-1} - 4a_{n-2}$ $(n \geq 2)$.

Problem 9. Let S, T be sets. Prove that $S \Delta T \subseteq S \cup T$.

Problem 10. Let R, S, T be sets. Prove that $R \times (S \cap T) \subseteq (R \times S) \cap (R \times T)$.