

Exam 1: Logic & Set Theory  
PRACTICE EXAM

Name:

**You have 75 minutes to complete the following questions without access to books or notes. Show all work and clearly indicate your solutions.**

1. (30 pts.) Let  $R = \{-2, 0, 2, 4\}$ ,  $S = \{-2, -1, 1, 2, 4\}$ ,  $T = \{0, 1, 2, 4\}$  and  $U = \{-2, -1, 0, 1, 2, 3, 4, 5\}$ .

(a) Write a word description of the universal set,  $U$ .

(b) Find  $n(S)$ .

(c) Determine the number of subsets of  $T$ .

(d) List the elements of the set  $((S' \cap R) \cup T)'$ .

(e) List the elements of the set  $S - T$ .

(f) Determine if the following statements are true or false.

(i)  $0 \in S$

(ii)  $\emptyset \subseteq S$

(iii)  $n(S \times R) = 9$

(iv)  $S \subset (T \cup R)$

(v)  $n(T' \cap R) = n(T \cup R')$

(g) Draw a Venn diagram representing these sets.

2. (18 pts.) Given the following information, determine the cardinality of each region in the associated Venn diagram.

$$n(A) = 22, n(B) = 18, n(A \cup B) = 33, n(A \cap B \cap C') = 2$$

$$n(B \cap C') = 12, n(A \cap C) = 14, n((A \cup B \cup C)') = 7, n(A' \cap C) = 14$$

3. (18 pts) Negate the following statements. Simplify symbolic logic when possible.

(a)  $x \leq 9$

(b)  $p \wedge \sim q$

(c)  $(p \vee \sim q) \rightarrow \sim r$

(d) All students take chemistry.

(e) The dog is playful or the cat isn't happy.

(f) If I go to school, and get good grades, then I will graduate.

4. (8 pts.) Complete a truth table for the statement  $(p \wedge \sim q) \vee \sim p$ .

5. (10 pts.) Determine if the following arguments are valid.

(a) It will rain or it will snow.

It rains.

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It does not snow.

(b)  $q \vee p$

$q \vee \sim p$

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$p \rightarrow q$

6. (7 pts.) Rewrite the following argument using symbolic logic and determine if the argument is valid.

*If Paul is my friend then Sarah is my enemy. Sarah is not my enemy or Samuel is my friend. Samuel is not my friend. Therefore, Paul is not my friend.*

7. (9 pts.) Consider the following statement.

*If it is over 90 degrees then I will not be running the marathon.*

(a) What's the converse of this statement?

(b) What's the inverse of this statement?

(c) What's the contrapositive of this statement?