Score: /25

CS 222
Spring 2021

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Homework 1: Set Theory

Due date: Friday 2/5 Submit the assignment via Canvas Assignments. Upload homework as one pdf document. A scanner app like Cam Scanner will make this possible.

Print and write work on this worksheet. Write **clearly** and show **all work** for full credit.

True or False. (1 point each)

1. __False__ $45 \in \{1,3,5,7,9,...\}$

2. __False__ $8 \notin \{x | x \in \mathbb{N} \wedge x \geq 8\}$

3. __True__ $\{b,c,d\} \subseteq \{b,c,d\}$

4. __False__ $\{ \} \subset \{ \}$

5. __True__ for any set S, $\emptyset \subseteq S$

6. __True__ $T \subseteq S$ and $S \subseteq T$ if and only if $S = T$

$$3,9 \quad 3,4$$

7. __False__ $|\{1,2,3\}| = |\{1,2,\{3,4\}\}|$

$$0 \quad 1 \quad 2 \quad 3 \quad 1,2 \quad 1,3 \quad 2,3 \mid 2 \}$$
$$0 \quad 1 \quad 2 \quad 3 \quad 4 \mid 1$$

8. Edit the false statements in #1-7 to make them true. Answers may vary. (2 points)

1. $45 \in \{5, 10, 15 \dots\}$
2. $8 \in \{x | x \in \mathbb{N} \land x \leq 8\}$
3.
4. $\{ \} \subseteq \{ \ \}$
7. $|\{1,2,3\}| \leq |\{1,2,\{3,4\}\}|$

7. $|\ldots|$

9. Let $A = \{x | x, k \in \mathbb{N}, x = k^3, k < 4\}$. List all the subsets of A. (2 points)

$K = 1, 2, 3$

$x = 1, 8, 27$

$A = \{x | x, k \in \mathbb{N}, x = k^3, k < 4\} = \{1, 8, 27\}$

Subsets:

$\emptyset \ \{1\}, \{8\}, \{27\}, \{1,8\}, \{1,27\}, \{8,27\}, \{1,8,27\}$

10. Consider some set, T, created by the formula 3^n, where n is a natural number and $n \geq 1$.

Provide three representations:

a. **Enumeration (2 points)**

$T = \{x | x, n \in \mathbb{N} \ x = 3^n, n \geq 1\}$

$n = 1, 2, 3, 4 \dots$

$x = 3, 9, 27 \dots$

$T = \{3, 9, 27 \dots\}$

b. **Formal Rule (2 points)**

$T = \{x | x, n \in \mathbb{N} \ x = 3^n, n \geq 1\}$

c. **Recursive Formula (2 points)**

$T = \begin{cases} t_1 = 3 \\ t_2 = 9 \\ t_n = 3^n \end{cases}, n \in \mathbb{N}, n \geq 1 \}$

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11. Let $U = \{0, 1, 2, ..., 10\}$, $A = \{0, 2, 4, 6, 8, 10\}$ and $B = \{0, 1, 2, 3, 4, 5, 6\}$. Find:

d. $\overline{A \cup B}$ (2 points)

$$A \cup B = \{0, 1, 2, 3, 4, 5, 6, 8, 10\}$$

$$\overline{A \cup B} = \{7, 9\}$$

e. $\bar{A} \cap \bar{B}$ (2 points)

$$\bar{A} = \{1, 3, 5, 7, 9\}$$
$$\bar{B} = \{7, 8, 9, 10\}$$

$$\bar{A} \cap \bar{B} = \{7, 9\}$$

12. Use a membership table to establish $\overline{A \cup B} = \bar{A} \cap \bar{B}$ (4 points)

A	B	A∪B	$\overline{A \cup B}$	$\bar{A}$	$\bar{B}$	$\bar{A} \cap \bar{B}$
0	0	0	1	1	1	1
0	1	1	0	1	0	0
1	0	1	0	0	1	0
1	1	1	0	0	0	0

1: $X \in$ given set

0: $X \notin$ given set