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MATH 2220
HOMEWORK ON SETS AND SUBSETS

1. [SSB921] Define the following sets:

- $A = \{x \in \mathbb{Z} : x \text{ is an integer multiple of } 3\}$
- $B = \{x \in \mathbb{Z} : x \text{ is a perfect square}\}$
- $C = \{4, 5, 9, 10\}$
- $D = \{2, 4, 11, 14\}$
- $E = \{3, 6, 9\}$
- $F = \{4, 9, 16\}$

Indicate which of the following statements are true:

- | | | | |
|---------------------|-------|--------------------|-------|
| (a) $D \subseteq C$ | false | (e) $A \in E$ | false |
| (b) $27 \in A$ | true | (f) $100 \in B$ | true |
| (c) $27 \in B$ | false | (g) $144 \in A$ | true |
| (d) $E \in A$ | true | (h) $15 \subset A$ | false |

2. [SSB535] What is the power set of $\{1\}$?

$$\mathcal{P}(\{1\}) = \{\emptyset, \{1\}\} = 2$$

3. [SSB532] Let $X = \{1, \{1\}, \{1, 2\}, 2\}$.

(a) What is $|X|$? $|X| = 4$

(b) Which of the following are true?

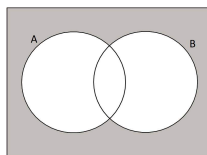
- | | |
|----------------------------|-------|
| i. $2 \in X$ | true |
| ii. $\{2\} \subseteq X$ | true |
| iii. $\{2\} \in X$ | false |
| iv. $1 \in X$ | true |
| v. $\{1, 2\} \in X$ | true |
| vi. $\{1, 2\} \subseteq X$ | true |

4. [SSB228] What is the cardinality of $\mathcal{P}(\{1, 2, 3, 4, 5\})$?

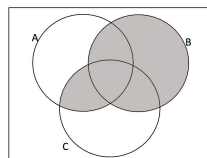
$$2^5 = 32$$

5. [OPS641] Draw a Venn diagram illustrating the following sets:

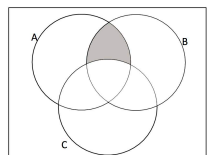
(a) $\overline{A \cup B}$



(b) $(A \cap C) \cup B$

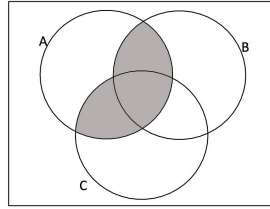


(c) $A \cap (B - C)$

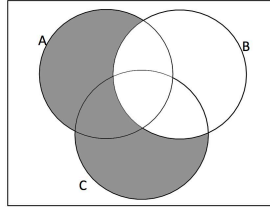


6. [OPS636] Draw Venn diagrams for the following set expressions:

(a) $A \cap (B \cup C)$



(b) $\overline{B} \cap (A \cup C)$



7. [OPS207] Define the following sets as:

- $A = \{x \in \mathbb{Z} : x \text{ is an integer multiple of } 3\}$
- $B = \{x \in \mathbb{Z} : x \text{ is a perfect square}\}$
- $C = \{4, 5, 9, 10\}$
- $D = \{2, 4, 11, 14\}$
- $E = \{3, 6, 9\}$
- $F = \{4, 9, 16\}$

What are the following sets? Express your answer by listing the elements in curly braces. You can assume the universe set is \mathbb{Z} .

- (a) $E \cap F = \{6\}$
 (b) $(C \cap F) \cup E = \{4, 9, 36\}$
 (c) $C - B = \{5, 10\}$
 (d) $E - A = \{\emptyset\}$
 (e) $\overline{B} \cap D = \{2, 11, 19\}$
 (f) $\overline{A} \cap (C \cup D) = \{9\}$

8. [OPS195] Define the following sets:

- $A = \{x \in \mathbb{Z} : x \text{ is even}\}$
- $B = \{x \in \mathbb{R} : x \geq 1\}$
- $C = \{-3, 1, 2, 6, 7, 9\}$
- $D = \{2, 3, 5, 9, 10, 17\}$

Indicate whether the following statements are true or false:

- (a) $\pi \in B$ a - true
 (b) $A \subseteq B$ b - true
 (c) $C \subseteq B$ c - false
 (d) $8 \in A \cap B$ d - true
 (e) $A \cap C \subseteq B$ e - true
 (f) $C \subseteq A \cup B$ f - false
 (g) $A \cap C \cap D = \emptyset$ g - false
 (h) $|C| = |D|$ h - true
 (i) $|C \cap D| = 3$ i - false