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The point values for each question is given within []. The total number of points for this assignment is 65 .
[12] 1. Describe each of the following sets by listing its elements:
(a) $\left\{x \mid x \in \mathbb{N}\right.$ and $\left.x^{2}-5 x+6=0\right\}$
(b) $\left\{\left.\frac{1}{x} \right\rvert\, x \in\{2,4,6,8\}\right\}$
(c) $\left\{x \mid x \in \mathbb{R}\right.$ and $\left.x^{2}=7\right\}$
(d) $\left\{x \mid x \in \mathbb{N}\right.$ and $\left.x^{2}-2 x-8=0\right\}$
(e) $\left\{x^{2} \mid x \in\{-2,-1,0,1,2\}\right\}$
(f) $\{x \in \mathbb{P} \mid x$ is a factor of 24$\}$
2. Let

$$
\begin{aligned}
A & =\{2,4,5,6,8\} \\
B & =\{1,4,5,9\} \\
C & =\{x \mid x \in \mathbb{Z} \text { and } 2 \leq x<5\}
\end{aligned}
$$

be subsets of $U=\{0,1,2,3,4,5,6,7,8,9\}$. Find
(a) $A \cup B$
(b) $A \cap B$
(c) $A \cap C$
(d) $B \cup C$
(e) $A-B$
(f) $A^{C}$
(g) $A \cap A^{C}$
(h) $(A \cap B)^{C}$
(i) $C-B$
(j) $(C \cap B) \cup A^{C}$
(k) $(B-A)^{C} \cap(A-B)$
(1) $\left(C^{C} \cap B\right)^{C}$
(m) $U^{C}$
(n) $B \times C$
(o) $\wp(B)$
(p) $A \oplus B$
(q) $B \oplus C$
(r) $|U|$
(s) $|U \times U|$
(t) $|\wp(U \times U)|$
(u) $|\varnothing|$
(v) $|\{\varnothing\}|$
[8]
3. Let

$$
\begin{aligned}
& A=\{x \mid x \text { is a word that appears before } d o g \text { in an English language dictionary }\} \\
& B=\{x \mid x \text { is a word that appears after canary in an English language dictionary }\} \\
& C=\{x \mid x \text { is a word of more than four characters }\}
\end{aligned}
$$

Which of the following are true statements?
(a) $B \subseteq C$
(b) $A \cup B=\{x \mid x$ is a word in an English language dictionary $\}$
(c) cat $\in B \cap C^{C}$
(d) bamboo $\in A-B$
[6] 4. Suppose $U$ is an infinite universal set, and $A$ and $B$ are infinite subsets of $U$. Answer the following questions and justify your answer.
(a) Must $A^{C}$ be infinite?
(b) Must $A \cup B$ be infinite?
(c) Must $A \cap B$ be infinite?
5. Find the binary representation of each of the following positive integers:
(a) 64
(b) 67
(c) 28
(d) 256
[10] 6. Calculate the following series:
(a) $\sum_{i=1}^{10} i$
(b) $\sum_{i=1}^{5} 20$
(c) $\sum_{j=1}^{5}(2 j+1)$
(d) $\sum_{i=-n}^{n} i$, for $n=1,2,3,4$
(e) $\prod_{i=1}^{5} i$
7. Draw the Venn diagram for $\bigcap_{i=1}^{4} A_{i}$

