

QUESTION BANK ON SET THEORY

Q1 If $A = \{a, b, \{c\}, \{d, e\}, f\}$, which of the following are incorrect and why?

- (i) $\{a\} \in A$ (ii) $a \subset A$
 (iii) $\{c\} \in A$ (iv) $\{c\} \subset A$
 (v) $\{\{c\}\} \in A$ (vi) $\{\{c\}\} \subset A$
 (vii) $\{a, b, c\} \in A$ (viii) $\{a, b, c\} \subset A$
 (ix) $\{d, e\} \in A$ (x) $\{d, e\} \subset A$
 (xi) $\phi \in A$ (xii) $\phi \subset A$
 (xiii) $\{\phi\} \subset A$ (xiv) $\{\phi\} \in P(A)$

Q2. How many elements does $P(A)$ have if

- (i) $A = \{a\}$ (ii) $A = \{a, b\}$ (iii) $A = \{1, 2, 3\}$
 (iv) $A = \phi$ (v) $A = \{\phi, \{\phi\}\}$

Q3. Which of the following is always true?

- (a) $P(P(S)) = P(S)$
 (b) $P(S) \cap S = P(S)$
 (c) $P(S) \cap P(P(S)) = \phi$
 (d) $S \notin P(S)$

Q4. Prove or disprove the following:

- (i) $(A \cup B)^c = A^c \cap B^c$
 (ii) $(A \cap B)^c = A^c \cup B^c$
 (iii) $P(A \cup B) = P(A) \cup P(B)$
 (iv) $P(A \cap B) = P(A) \cap P(B)$

Q5 Classify the following sets as "uncountable", "countably infinite", "finite". If finite, find their cardinality.

a) $A = \{2, 3, 8, 10, 11\}$

b) $A =$ Set of positive integers less than 1

c) $A =$ Set of positive divisors of 12

d) $A =$ Set of positive multiples of 12

e) $A = \{x \in \mathbb{C} / x^{23} + 18x^{15} + 17x^3 + 1 = 0\}$

f) $A =$ Set of prime numbers

h) $A =$ Set of lines parallel to y-axis in $[0, 2]$

i) $A =$ Set of ^{positive} rational numbers

j) $A =$ set of odd integers

k) $A =$ set of circles centered at origin

l) $A =$ set of circles centered at origin with rational radius.

m) $A = [0, 1]$

n) $A = (0, 1)$

o) $A = (a, b)$

p) $A = \mathbb{R}$

q) $A = \{\emptyset, \{\emptyset\}, \{\emptyset, \{\emptyset\}\}, \{\emptyset, \{\emptyset\}, \{\emptyset, \{\emptyset\}\}\}$