CS & IT ENGINEERING

Discrete Mathematics

Set Theory

DPP 02
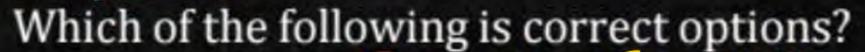
Discussion notes

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Q.1 Suppose A, B, C and D are subsets of U (the universe) with A as a subset of B and C as subset of D i.e $A \subseteq B$ and $C \subseteq D$, then consider the following statements

[MCQ]

True I. $A \cap C \subseteq B \cap D$

True II. $A \cup C \subseteq B \cup D$

Which of the following is correct options?

A. Only I is true

B. Only II is true

C. Neither I nor II is true

D. Both I and II are true

$A \subseteq B, \quad C \subseteq D$

$U = \{1, 2, 3, 4\}$

I. $A = \{1, 2\}$ $\quad \{B = \{1, 2, 3\}$

$C = \{2\}$ $\quad \{D = \{2, 3\}$

$A \cap C = (2) \subseteq B \cap D = \{2, 3\}$

II. $B \cup D = \{1, 2, 3, 4\}$

$A \cup C = \{1, 2\}$ ✓

Q.2 Let A = {1, 2, 3, ... 15}. How many subsets of A contains all of the odd integers in A? **128**
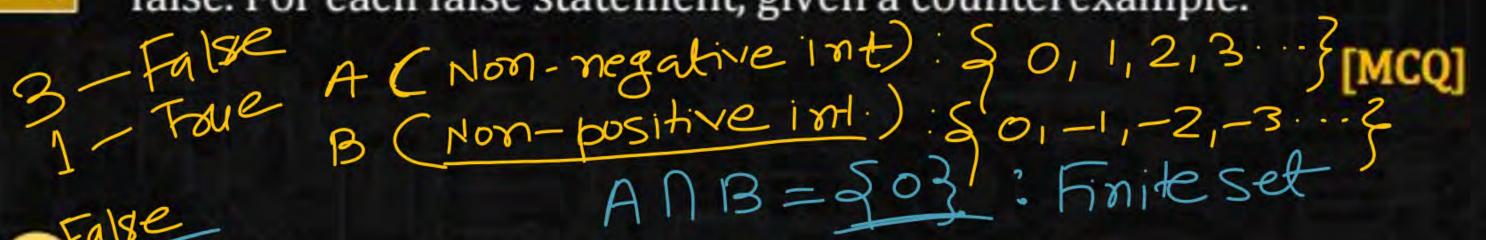
[NAT]
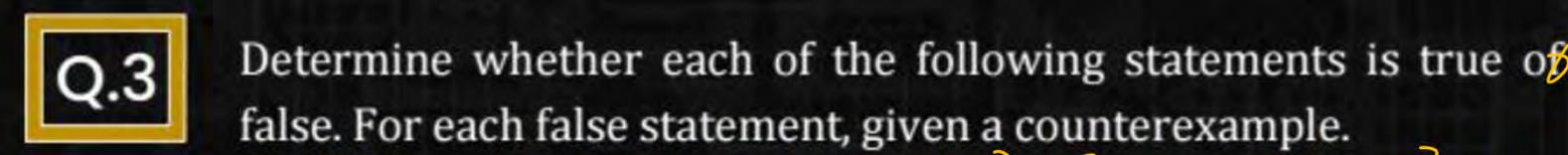
odd integers in A = $\{1, 3, 5, 7, 9, 11, 13, 15\}$

These elements must be the part our set.

Even integers in A: $\{2, 4, 6, 8, 10, 12, 14\}$

7 even elements

Subset: $\{$ All odd int. $\} $ & $\{$ Even int. $\}$

7 element

$2^7 = \boxed{128}$

$\{ 1 \ldots \ldots 15 \}.$

odd values

① $\{ 1, 2 \cdots \}$

odd

② $\{ 1, 4 \cdots \}$

odd

$\{ \{2\} \{4\}, \{6\}, \{8\},$
$\{10\}, \{12\}, \{14\} \cdots$
$\{2,4\} \cdots - \}$

Q.3

Determine whether each of the following statements is true of false. For each false statement, given a counterexample.

$3 - \text{False}$
$1 - \text{True}$

$A \text{ (Non-negative int)} : \{0, 1, 2, 3 \cdots\}$ [MCQ]
$B \text{ (Non-positive int.)} : \{0, -1, -2, -3 \cdots\}$

$A \cap B = \{0\} : \text{Finite set}$

A. False — If A and B are infinite sets, then $A \cap B$ is infinite.

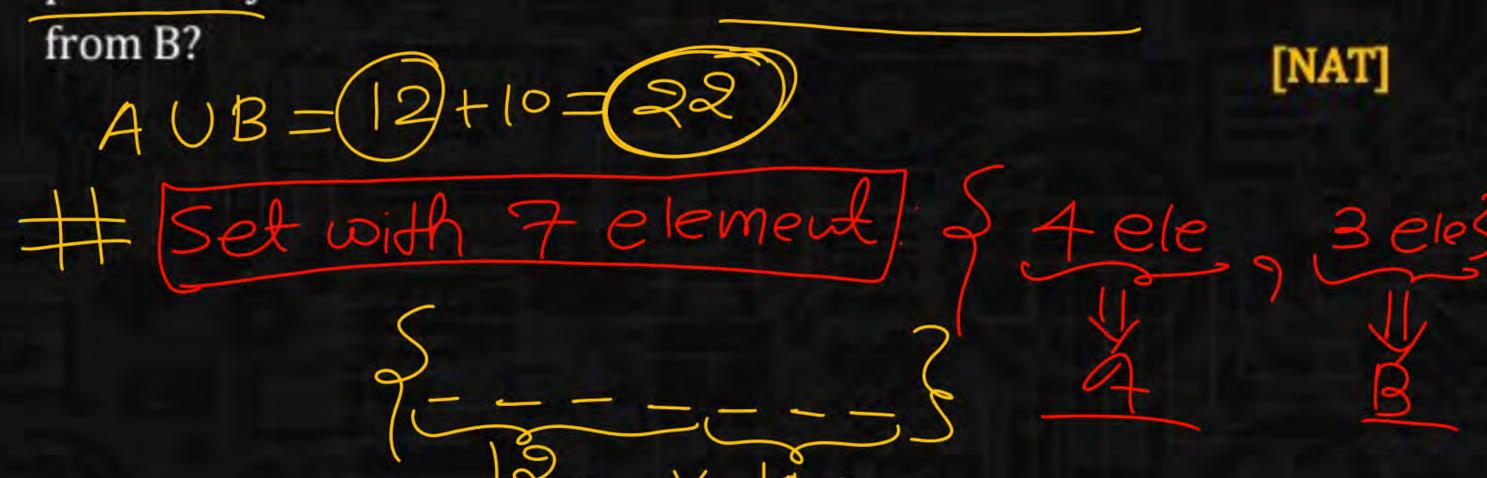**B.** False — If B is infinite and $A \subseteq B$, then A is infinite.

$A_1 \subseteq B$
$A_1 = \{-1, -2, -3\}$
Finite set

C. True — If $A \subseteq B$ with B finite, then A is finite.

$(A) \subseteq (B)$

D. False — If $A \subseteq B$ with A finite, then B is finite.

$B = \{1, 2, 3\}$ finite
$2^3 = 8$

Q.4 Let U be a given universe with $A, B \subseteq U, A \cap B = \phi, |A| = 12$, and $|B| = 10$. If seven elements are selected from $A \cup B$, what is the probability the selection contains four elements from A and three from B?

[NAT]

$$A \cup B = \boxed{12} + 10 = \boxed{22}$$

\# Set with 7 element $\{$ 4 ele, 3 ele $\}$

$$\{ ----- \}$$

4 ele $\rightarrow$ A

3 ele $\rightarrow$ B

$$\frac{^{12}C_4 \times {}^{10}C_3}{} $$

$$495 \times 120$$

$$\text{Prob} : \frac{\text{Fav. Cases}}{\text{Total Cases}} = \frac{{}^{12}C_4 * {}^{10}C_3}{{}^{22}C_7}$$

$$= 0.3483$$

Q.5 Let $A, B \subseteq R$, where $A = \{x \mid x^2 - 7x = -12\}$ and $B = \{x \mid x^2 - x = 6\}$ Determine $A \cup B$ and $A \cap B$.

[MCQ]

$$A \cap B = \{3\}$$
$$A \cup B = \{-2, 3, 4\}$$

A. $A \cup B = \{5\}$ and $A \cap B = \{-2, 3, 4\}$ ✗

B. $A \cup B = \{3\}$ and $A \cap B = \{-2, 3, 4\}$ ✗

C. $A \cup B = \{-2, 3, 4\}$ and $A \cap B = \{3\}$

D. $A \cup B = \{2, 3, 4\}$ and $A \cap B = \{5\}$

$$A: \quad x^2 - 7x = -12$$
$$x^2 - 7x + 12 = 0$$
$$x^2 - 3x - 4x + 12 = 0$$
$$x(x-3) - 4(x-3) = 0$$
$$(x-3)(x-4) = 0$$
$$\therefore \quad x = 3, 4$$

B: $x^2 - x = 6$

$x^2 - x - 6 = 0$

$x^2 - 3x + 2x - 6 = 0$

$x(x-3) + 2(x-3) = 0$

$(x-3)(x+2) = 0$

$x : \boxed{3, -2}$