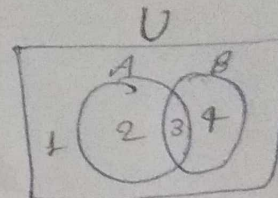


Q.22 Prove the following using the venn digrams

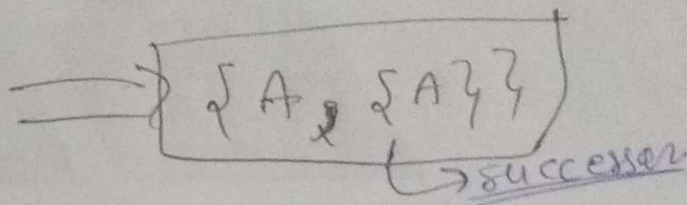
- ☒ a) $(A \cap B) \subseteq A$ ☒ b) $(A \cap B) \subseteq B$
☒ c) $A - B \subseteq B \cup A$ ☒ d) $A \cap (B - A) = \emptyset$
☒ e) $A \cup (B - A) = A \cup B$
☒ f) $A - B = A \cap \bar{B}$
☒ g) $(A \cap B) \cup (A \cap \bar{B}) = A$



Q.23 What can you say about sets A and B if $A \Delta B = A \Rightarrow A \oplus B = A \Rightarrow \boxed{B = \emptyset}$

Q.24 find the successors of the following sets.

- (a) $\{1, 2, 3\} \rightarrow \{\{1, 2, 3\}, \{\{1, 2, 3\}\}\}$
 (b) $\emptyset \rightarrow \{\emptyset, \{\emptyset\}\}$
 (c) $\{\emptyset\} \rightarrow \{\{\emptyset\}, \{\{\emptyset\}\}\}$
 (d) $\{\emptyset, \{\emptyset\}\} \rightarrow \{\{\emptyset, \{\emptyset\}\}, \{\{\emptyset, \{\emptyset\}\}\}\}$



Q.25 In which of the following it can be concluded that $A=B$ if A, B and C are sets such that

- (a) $A \cup C = B \cup C$
 (b) $A \cap C = B \cap C$
☒ (c) $A \cup C = B \cup C$ and $A \cap C = B \cap C$
 (d) None of these

Q.26 Let A and B be the multisets $\{3.a, 2.b, 1.c\}$ and $\{2.a, 3.b, 4.d\}$, respectively. Find

- (a) $A \cup B \rightarrow \{3a, 2b, 1c, 2d\}$ (b) $A \cap B \rightarrow \{2a, 2b\}$
 (c) $A - B \rightarrow \{1a, 1c\}$ (d) $B - A \rightarrow \{1b, 4d\}$
 (e) $A + B \rightarrow \{5a, 5b, 1c, 4d\}$

Q.27 Which of the following operations cannot be performed on the Multisets?

- a) Union
 b) Set difference
☒ c) Symmetric Difference
 d) Complement

Q.28 If $S = \{a, b, c\}$, A_1 and A_2 are disjoint sets such that $A_1 \cup A_2 = S$. The number of possible solutions for A_1 and A_2 are $2^3 = \boxed{8}$ And $|S| = 3, A_1 \cap A_2 = \emptyset$

Q.29 If $n(A) = 28$, $n(B) = 32$ and $n(A \cup B) = 50$, find $n(A \cap B) = 28 + 32 - 50 = 10$ Ans

Q.30 If $A \cap B = A \cap C$ and $A \cup B = A \cup C$ then what is the relationship between B and C? $\Rightarrow B = C$ Ans

Q.31 In a class of 58 students, 20 follows cricket, 38 follows hockey and 15 follows basket ball. 3 students follow all the 3 games, how many students follow exactly 2 of 3 games? $\Rightarrow 58 - 20 - 38 - 15 + 3 = 8$ Ans

Q.32 There was a survey in the city about number of people reading newspaper A, B and C. There are 42% of people reading newspaper A, 51% people reading B and 68% reading C. 30% people read both A and B, 28% read B and C, 36% read A and C. 8% don't read any paper. Find the percent of people who reads all 3 newspapers. $\Rightarrow n(A \cap B \cap C) = 92 + 94 - 42 - 51 - 68 = 23$ Ans

Q.33 In a class of 100 students, 12 students drink only milk and 5 students drink only coffee and 8 students drink only tea. 30 students drink both coffee and tea, 25 students drink only milk and tea and 20 drink only milk and coffee. 10 drink all the 3 drink. Find number of students not taking any drink. $\Rightarrow 100 - 12 - 5 - 8 - [20 + 25 + 20] + 10 = 0 = 0$

Q.34 In a town of 10,000 families, 40% buy newspaper A, 20% buy newspaper B and 10% buy newspaper C. 5% buys A and B, 3% buy B and C whereas 4% buy A and C. If 2% buy all 3 newspapers, how many families buy only newspaper A, given that every family reads at least one newspaper? $\Rightarrow A = 33\% \times \frac{10000}{100} = 3300$

Q.35 If $n(A-B) = 25 + x$, $n(B-A) = 2x$ and $n(A \cap B) = 2x$. if $n(A) = 2[n(B)]$. Then find x. $\Rightarrow 25 + 3x = 8x \Rightarrow x = 5$

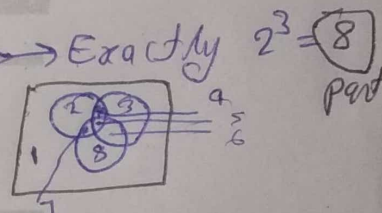
Q.36 Suppose there are 21 cricket players in the Indian team. Out of these, 6 players are taking part in a one day match, 7 players are taking part in twenty-20 match and 5 players are taking part in both one day and twenty-20 matches. How many players are not taking part either in a one day or in twenty matches? $\Rightarrow n(A \cup B) = 21 - (7 + 5 + 2) = 13$

Q.37 30 cars were assembled in a factory. The options available were a radio and air conditioner and white-wall tires. It is known that 15 of the cars have radios, 8 of them have air conditioners and 6 of them have white-wall tires. Moreover, 3 of them have all 3 options. At least how many cars do not have any options at all? $30 - 15 + 8 + 6 - (3) + 8 = 7$

Q.38 Among 50 students in a class if the number of students got grade A in the 1st examination is equal to that in the 2nd examination, if the total number of students who got grade A in exactly one examination is 40, and if 4 students didn't get grade A in either examination, determine the number of students who got grade A in the first examination only, who got grade A in the 2nd examination only, and who got grade A in both examinations.

Q.39 Find the minimum number of possible regions in a Venn diagram of 3 sets.

Q.40 Find the maximum number of possible regions in a Venn diagram of 3 sets.



GATE and other engineering exams previous questions

Q.1 Let S be an infinite set and S_1, S_2, \dots, S_n be sets such that $S_1 \cup S_2 \cup \dots \cup S_n = S$. Then

(A) At least one of the sets S_i is a finite set

(B) Not more than one of the sets S_i can be finite

(C) At least one of sets S_i is infinite

(D) Not more than one the sets S_i is an a infinite set [1993:1 Mark]

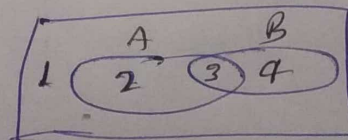
Q.2 Let A and B be sets and let A^c and B^c denote the complements of the sets A and B. The set $(A - B) \cup (B - A) \cup (A \cap B)$ is equal to

(A) $A \cup B$

(B) $A^c \cup B^c$

(C) $A \cap B$

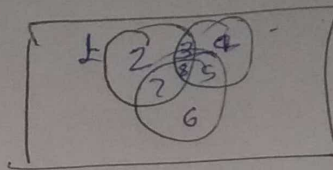
(D) $A^c \cap B^c$



[1996:1 Mark]

Q.3 Let A, B and C be non-empty sets and let $X = (A - B) - C$ and $Y = (A - C) - (B - C)$. Which one of the following is TRUE?

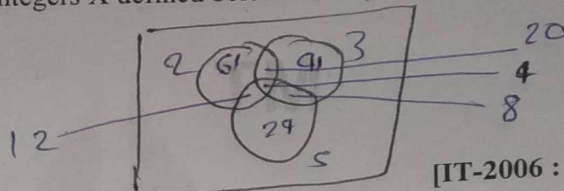
- (A) $X = Y$
 (B) $X \subset Y$
 (C) $Y \subset X$
 (D) None of these



[2005 : 1 Mark]

Q.4 What is the cardinality of the set of integers X defined below? $X = \{n \mid 1 \leq n \leq 123, n \text{ is not divisible by } 2, 3 \text{ or } 5\}$

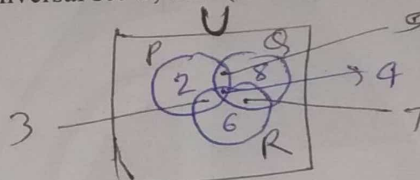
- (A) 28
 (B) 33 $\rightarrow n(A \cap B \cap C)$
 (C) 37
 (D) 44



[IT-2006 : 2 Marks]

Q.5 If P, Q, R are subsets of the universal set U, then $(P \cap Q \cap R) \cup (P \cap Q \cap R)^c \cup Q^c \cup R^c$ is

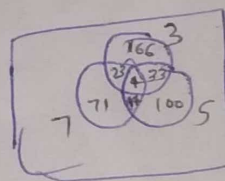
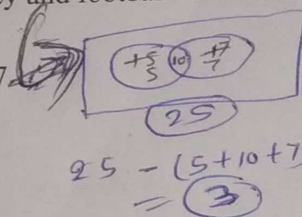
- (A) $Q^c \cup R^c$
 (B) $P \cup Q^c \cup R^c$
 (C) $P^c \cup Q^c \cup R^c$
 (D) U



[2008:1 Mark]

Q.6 25 persons are in a room. 15 of them play hockey, 17 of them play football and 10 of them play both hockey and football. Then the number of persons playing neither hockey nor football is

- (A) 2
 (B) 17
 (C) 13
 (D) 3



[2010 : 1 Mark]

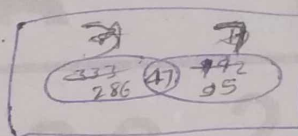
Q.7 The number of integers between 1 and 500 (both inclusive) that are divisible by 3 or 5 or 7 is

[2017 (Set-1) : 1 Mark]

[TIFR 2013]

Q.8 Among numbers 1 to 1000 how many are divisible by 3 or 7?

- (A) 333
 (B) 142
 (C) 475
 (D) 428
 (E) None of the above

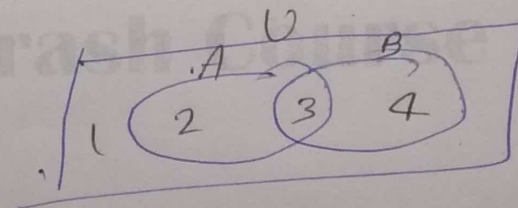


$$286 + 47 + 95$$

$$= 428$$

Q.9 Let A, B be sets. Let \bar{A} denote the complement of set A (with respect to some fixed universe) and $(A - B)$ denote the set of elements in A which are not in B. Set $(A - (A - B))$ is equal to : [TIFR 2013]

- (A) B
 (B) $A \cap \bar{B}$
 (C) $A - B$
 (D) $A \cap B$
 (E) \bar{B}



Q.10 Let A and B be finite sets such that $A \subseteq B$. Then, what is the value of the expression

$$\sum_{C: A \subseteq C \subseteq B} (-1)^{|C \setminus A|}$$

where $C \setminus A = \{x \in C : x \notin A\}$?

[TIFR 2016]

- (A) Always 0
 (B) Always 1
 (C) 0 if $A = B$ and 1 otherwise.
 (D) 1 if $A = B$ and 0 otherwise
 (E) Depends on the size of the universe

Q.11 Which one of the following is 'true' ?

- (A) $R \cup S = (R \cup S) - [(R - S) \cup (S - R)]$
 (B) $R \cup S = (R \cap S) - [(R - S) \cup (S - R)]$
 (C) $R \cap S = (R \cup S) - [(R - S) \cap (S - R)]$
 (D) $R \cap S = (R \cup S) \cup (R - S)$

[ISRO 2011]

Q.12 The symmetric difference of sets $A = \{1, 2, 3, 4, 5, 6, 7, 8\}$ and $B = \{1, 3, 5, 6, 7, 8, 9\}$ is

- (A) $\{1, 3, 5, 6, 7, 8\}$
 (B) $\{2, 4, 9\}$
 (C) $\{2, 4\}$
 (D) $\{1, 2, 3, 4, 5, 6, 7, 8, 9\}$

[ISRO 2017]

Q.13 The number of elements in the power set of $\{\{1, 2\}, \{2, 1, 1\}, (2, 1, 1, 2)\}$ is

[ISRO 2017]

- (A) 3
 (B) 8
 (C) 4
 (D) 2

Q.14 Which of the following is not true?

- (A) $A \oplus B = (A - B) \cup (B - A)$
 (B) $A - B = A \cap \sim B$
 (C) $A \oplus B = (A \cup B) - (A \cap B)$
 (D) $A - B = A \cup \sim B$

[NET 2006]

Q.15 The number of integers between 1 and 250 that are divisible by 2, 5 and 7 is

- (A) 2
 (B) 3
 (C) 5
 (D) 8

Handwritten solution for Q.15:

$$\left[\frac{250}{\text{LCM}(2, 5, 7)} \right] = \left[\frac{250}{70} \right] = 3$$

$$A \cup B = \{2, 3, 5, 7, 8, 9\}$$

$$= 2^6 = 64$$

[NET 2010]

Q.16 The power set of $A \cup B$, where $A = \{2, 3, 5, 7\}$ and $B = \{2, 5, 8, 9\}$ is

- (A) 256
 (B) 64
 (C) 16
 (D) 4

[NET 2012]

Q.17 Given $U = \{1, 2, 3, 4, 5, 6, 7\}$ $A = \{(3, 0.7), (5, 1), (6, 0.8)\}$ then \tilde{A} will be : (where $\sim \rightarrow$ complement)

- (A) $\{(4, 0.7), (2, 1), (1, 0.8)\}$
 (B) $\{(4, 0.3), (5, 0), (6, 0.2)\}$

(C) $\{(1, 1), (2, 1), (3, 0.3), (4, 1), (6, 0.2), (7, 1)\}$

☒ (D) $\{(3, 0.3), (6, 0.2)\}$

[NET 2014]

Q.18 Consider a set $A = \{1, 2, 3, \dots, 1000\}$. How many members of A shall be divisible by 3 or by 5 or by both 3 and 5?

(A) 533

(B) 599

☒ (C) 467

(D) 66

[NET 2014]

Q.19 Let A and B be sets in a finite universal set U. Given the following :

$|A - B|, |A \oplus B|, |A| + |B|$ and $|A \cup B|$

Which of the following is in order of increasing size?

(A) $|A - B| \leq |A \oplus B| \leq |A| + |B| \leq |A \cup B|$

(B) $|A \oplus B| \leq |A - B| \leq |A \cup B| \leq |A| + |B|$

(C) $|A \oplus B| \leq |A| + |B| \leq |A - B| \leq |A \cup B|$

☒ (D) $|A - B| < |A \oplus B| < |A \cup B| < |A| + |B|$

[NET 2016]

Q.20 If $A_i = \{-i, \dots, -2, -1, 0, 1, 2, \dots, i\}$ then $\bigcup_{i=1}^{\infty} A_i$ is

☒ (A) \mathbb{Z}

(B) \mathbb{Q}

(C) \mathbb{R}

(D) \mathbb{C}

[NET 2018]