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Mathematical Induction:

Q.1:

Conjecture: $\underbrace{1+3+5+7+9\ldots\ldots+2n-1}_{n \text{ terms}} = n^2$

$$\sum_{k=1}^{n} (2k-1) = n^2 \qquad n \geq 1$$

Basis of Induction for $n=1$

$\Rightarrow \quad 1 = 1$ ✓

Induction Step: let for $n=k$ it is true.

Hence, $1+3+5+\ldots\ldots+(2k-1) = k^2$

Now, adding next term to both sides.

$1+3+5+\ldots+2k-1+2(k+1)-1 = k^2+2(k+1)-1$

$= (k+1)^2$

Hence, we can see it is true for $n=1$ then it is also true for $n=k+1$ whenever $n=k$ case was true. $\therefore$ It is true $\forall\, n \geq 1$ ✓

Q.2:

Given to show $1+2+2^2+\ldots+2^n = 2^{n+1}-1$

I. for $n=0$, we have $2^0 = 2^{0+1}-1$

$\Rightarrow 1 = 1$ ✓

II. for $n=k$, we have

$1+2+2^2+\ldots\ldots+2^k = 2^{k+1}-1$

III. Adding next term on both sides.

$1+2+2^2+\ldots+2^k+2^{k+1} = 2^{k+1}-1+2^{k+1}$

$= 2^{k+2}-1 = 2^{(k+1)+1}-1$

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We saw its true for: $n=0$

$n=k$ and then ~~n=~~ for $n=k+1$

Hence, true for all $n \geq 0$ by mathematical induction.

Q.3

Conjecture: $1^2+3^2+5^2+\dots+(2n+1)^2 = \frac{(n+1)(2n+1)(2n+3)}{3}$

$$\sum_{k=0}^{k=n} (2k+1)^2 = \frac{(n+1)(2n+1)(2n+3)}{3}$$

I. Checking for left side limit. $n=0$

$1^2 = 1$ ✓

II. Checking for $n=k$.

$\cancel{\sum_{k=0}^{k=n} 2k+1}$

$$1^2+3^2+5^2+\dots+(2k+1)^2 = \frac{(k+1)(2k+1)(2k+3)}{3}$$

III. Adding next term on both sides.

$$1^2+3^2+5^2+\dots+(2k+1)^2+(2(k+1)+1)^2$$

$$= \frac{(k+1)(2k+1)(2k+3)}{3} + (2k+3)^2$$

$$= \frac{(2k+3)}{3}\left[\frac{(k+1)(2k+1)}{\cancel{3}} + 3(2k+3)\right]$$

$$= \frac{(2k+3)}{3}\left[2k^2+9k+10\right]$$

$$= \frac{(2k+3)}{3}(k+2)(2k+5)$$

$$= \frac{[(k+1)+1][2(k+1)+1][2(k+1)+3]}{3}$$

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Hence by mathematical induction, it's true for all $n \geq 0$

Q.4

n^3+2n divisible by 3 for all $n \geq 1$

let $n^3+2n = 3m$ (where $m \in Z$)

I. Putting for $n=1$,

$1+2 = 3m \Rightarrow m \in Z$

Hence its a multiple of three for $n=1$.

II. let $n=k$

$k^3+2k = 3m$

III. Checking for next term $n=k+1$

$$(k+1)^3 + 2(k+1) = k^3+3k^2+3k+1+2k+2$$
$$= (k^3+2k)+3(k^2+k+1)$$
$$= 3m+3(k^2+k+1)$$
$$= 3(m+k^2+k+1)$$
$$= \cancel{3m'} = 3m'$$

Hence its divisible by 3, for $n=k+1$

By mathematical induction its true $\forall\ n \geq 1$

Q.5:

$2^n \times 2^n - 1$ divisible by 3 $\forall\ n \geq 1$

let $2^n \times 2^n - 1 = 3m$ (where $m \in Z$)

I. Putting for $n=1$.

$4-1 = 3m$ ~~me~~

$m=1 \in Z$.

Hence, a multiple of three for $n=1$.

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II. If true for a value k.

$$2^k \times 2^k - 1 = 3m$$

$$m \in \mathbb{Z}$$

III. Checking for the next value k+1

$$2^{k+1} \times 2^{k+1} - 1 = 4 \times (2^k \times 2^k) - 1$$
$$= 4 \times (3m+1) - 1$$
$$= 3m' + 3 \qquad (m' = 4m)$$
$$= 3(m'+1)$$
$$= 3m''$$

So, next value is also divisible by 3 $\qquad m'' \in \mathbb{Z}$

Hence, by mathematical induction, it is true for all $n \geq 1$.

Q. 6

$$1.\lfloor 1 + 2.\lfloor 2 + 3\lfloor 3 + 4\lfloor 4 + 5\lfloor 5 + \dots n\lfloor n = \lfloor n+1 - 1$$

for $n \geq 1$

I. Checking for basis of induction: $n = 1$

$$1.\lfloor 1 = \lfloor 1+1 - 1$$

$\therefore$ true for $n = 1$

II. If true for $n = k$

$$1\lfloor 1 + 2\lfloor 2 + 3\lfloor 3 + \dots k\lfloor k = \lfloor k+1 - 1$$

III. Checking for next value by adding.

$$1\lfloor 1 + 2\lfloor 2 + \dots + k\lfloor k + (k+1)\lfloor k+1 = \lfloor k+1 - 1 + (k+1)\lfloor k+1$$
$$= \lfloor k+2 - 1$$

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Hence, by mathematical induction its true for all $n \geq 1$

Q.7 Same as **Q.2**

Q.8 $n^5 - n$ divisible by 5 for $n \geq 0$.
let $n^5 - n = 5m$ (where $m \in \mathbb{Z}$)

I. Putting for left hand limit, $n = 0$

$$0 = 5m$$

$$m = 0 \quad (m \in \mathbb{Z})$$

Hence true for $n = 0$

II for induction let $n = k$.

$$k^5 - k = 5m$$

III. for next term, $n = k+1$

$$(k+1)^5 - (k+1) = \cancel{n^2 - n + 2n + 1 - 1}$$

$$= \cancel{(k+1)[(k+1)^4 - 1]}$$

$$= \cancel{(k+1)[\{(k+1)^2 + 1\}\{(k+1)^2 - 1\}]}$$

$$= \cancel{(k+1)[(k^2 + 2k + 2)(k^2 + 2k)]}$$

$$= \cancel{(k+1)[}$$ (using binomial)

$$= k^5 + 5k^4 + 10k^3 + 10k^2 + 5k + 1 - (k+1)$$

$$= k^5 - k + 5(k^4 + 2k^3 + 2k^2 + k)$$

$$= 5(m + k^4 + 2k^3 + 2k^2 + k)$$

$$= 5m'$$

Hence valid for $k+1$.
Its true for $n \geq 0$ by mathematical induction.

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~~Q.6~~ **Q.9** $n^2 - n$ is divisible by 2 for $n \geq 1$
Let $n^2 - n = 2m$ (where $m \in Z$)

I. ~~Induct~~ Basis of induction for $n = 1$

$1^2 - 1 = 2m$

$m = 0$ $m \in Z$ ✓

II. Induction step, let it true for $n = k$

$k^2 - k = 2m$ ✓

III for next ~~$ term,~~ term, $n = k+1$

$(k+1)^2 - (k+1) = k^2 + 2k + 1 - k - 1$

$= k^2 - k + 2k$

$= 2(m + k)$

Hence divisible by 2 ✓
By mathematical induction its true $\forall$ $n \geq 1$.

Q.10

$1.2.3 + 2.3.4 + \ldots \ldots + n(n+1)(n+2) = \frac{n(n+1)(n+2)(n+3)}{4}$

I. for left side limit, $n = 1$

$1.2.3 = \frac{1.2.3.4}{4}$

Hence, true for $n = 1$

II. Induction step: for $n = k$

$1.2.3 + 2.3.4 + \ldots + k.k+1.k+2 = \frac{k.(k+1)(k+2)(k+3)}{4}$

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IV. Now for next term we add on both sides

$$1.2.3 + \ldots + k(k+1)(k+2) + (k+1)(k+2)(k+3) = \frac{k(k+1)(k+2)(k+3)}{4} + (k+1)(k+2)(k+3)$$

$$= \frac{(k+1)(k+2)(k+3)}{4}[k+4]$$

$$= \frac{(k+1)(k+2)(k+3)(k+4)}{4}$$

$$= \frac{(k+1)(k+1+1)(k+1+2)(k+1+3)}{4}$$

Hence its true for $n=k+1$ when it was true for $n=k$
also it was true for $n=1$.
$\therefore$ Its true for all $n \geq 1$ by mathematical induction.

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Set Theory:

Q.1

a) $\phi \in \{\phi\}$ is True

b) $\phi \in \{\phi, \{\phi\}\}$ is True

c) $\{\phi\} \in \{\phi\}$ is false

d) $\{\phi\} \in \{\{\phi\}\}$ is true

e) $\{\phi\} \subset \{\phi, \{\phi\}\}$ is true

f) $\{\{\phi\}\} \subset \{\phi, \{\phi\}\}$ is true

g) $\{\{\phi\}\} \subset \{\{\phi\}, \{\phi\}\}$ is false

Q.2 List all the members of these sets.

~~a) $\{x \mid x \in R, x^2 = 1\} = x \in [-1, 1]$~~

~~$\{-1, \ldots, 0, \ldots, 1\}$~~

a) $\{x \mid x \in R, x^2 = 1\} = \{1, -1\}$

b) $\{x \mid x \in Z^+, x < 12\} = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11\}$

c) ~~$\{x \mid x \in Z$~~ $\{x \mid x$ is a square of an integer $x < 100\}$

$= \{0, 1, 4, 9, 16, 25, 36, 49, 64, 81\}$

d) $\{x \mid x$ is an integer such that $x^2 = 2\} = \{\}$

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Q.3

a) To show, $\phi \times A = A \times \phi = \phi$

we can show using cardinality.

we know, $|A \times B| = |A| \times |B|$

Hence, $|\phi \times A| = |A \times \phi| = |A| \cdot |\phi| = |A| \cdot 0 = 0$

Hence, ~~empt~~ as empty set cardinality is zero.

$\phi \times A = A \times \phi = \phi$

b) $A \times B \times C$ and $(A \times B) \times C$ are not same.

~~B~~ for cartesian product we know,

$A \times B = \{(x, y) \mid x \in A, \text{ and } y \in B\}$

while

$A \times B \times C = \{(x, y, z) \mid x \in A \text{ and } y \in B \text{ and } z \in C\}$

it contains triplets.

But $(A \times B) \times C = \{((x, y), z) \mid (x \in A \text{ and } y \in B) \text{ and } z \in C\}$

Here we can see it is ~~a~~ ~~co~~ has doublets with first value themselves being doublets.

Therefore $A \times B \times C$ is not same as $(A \times B) \times C$.

Q.4: $A = \{a, b, c\}$ $B = \{x, y\}$ $C = \{0, 1\}$

a) $A \times B \times C = \{(a, x, 0), (a, x, 1), (a, y, 0), (a, y, 1), (b, x, 0), (b, x, 1), (b, y, 0), (b, y, 1), (c, x, 0), (c, x, 1), (c, y, 0), (c, y, 1)\}$

b) $C \times B \times A = \{(0, x, a), (0, x, b), (0, x, c)$
$(0, y, a), (0, y, b), (0, y, c)$
$(1, x, a), (1, x, b), (1, x, c)$
$(1, y, a), (1, y, b), (1, y, c)\}$

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c) $C \times A \times B = \{(0,a,x), (0,a,y), (0,b,x), (0,b,y),$
$(0,c,x), (0,c,y), (1,a,x), (1,a,y),$
$(1,b,x), (1,b,y), (1,c,x), (1,c,y)\}$

d) $B \times B \times B = \{(x,x,x), (x,x,y), (x,y,x), (x,y,y),$
$(y,x,x), (y,x,y), (y,y,x), (y,y,y)\}$

Q.5: a) Power set.

a) $\{a\} \Rightarrow P = \{\phi, \{a\}\}$

b) $\{a,b\} \Rightarrow P = \{\phi, \{a\}, \{b\}, \{a,b\}\}$

c) $\{\phi, \{\phi\}\} \Rightarrow P = \{\phi, \{\phi\}, \{\{\phi\}\}, \{\phi, \{\phi\}\}\}$

Q.5 b) Cardinality:

a) ϕ $|S| = 0$

b) $\{\phi\}$ $|S| = 1$

c) $\{\phi, \{\phi\}\}$ $|S| = 2$

d) $\{\phi, \{\phi\}, \{\phi, \{\phi\}\}\}$ $|S| = 3$

Q.6.

Given, A : set of sophomores
B : set of students in discrete maths.

a) Sophomores taking discrete $A \cap B$

b) Sophomores not taking discrete $A - B$ or $A \cap \bar{B}$

c) Sophomore or taking discrete $A \cup B$ (A or B)

d) Not sophomore or not taking discrete $\bar{A} \cup \bar{B}$

$U - (A \cap B)$

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Q.7:

a) $A = \{1,2,3,4,5\}$ $\quad B = \{0,3,6\}$

a) $A \cup B = \{0,1,2,3,4,5,6\}$

b) $A \cap B = \{3\}$

c) $A - B = \{1,2,4,5\}$

d) $B - A = \{0,6\}$

b) $A = \{a,b,c,d,e\}$ $\quad B = \{a,b,c,d,e,f,g,h\}$

a) $A \cup B = \{a,b,c,d,e,f,g,h\}$

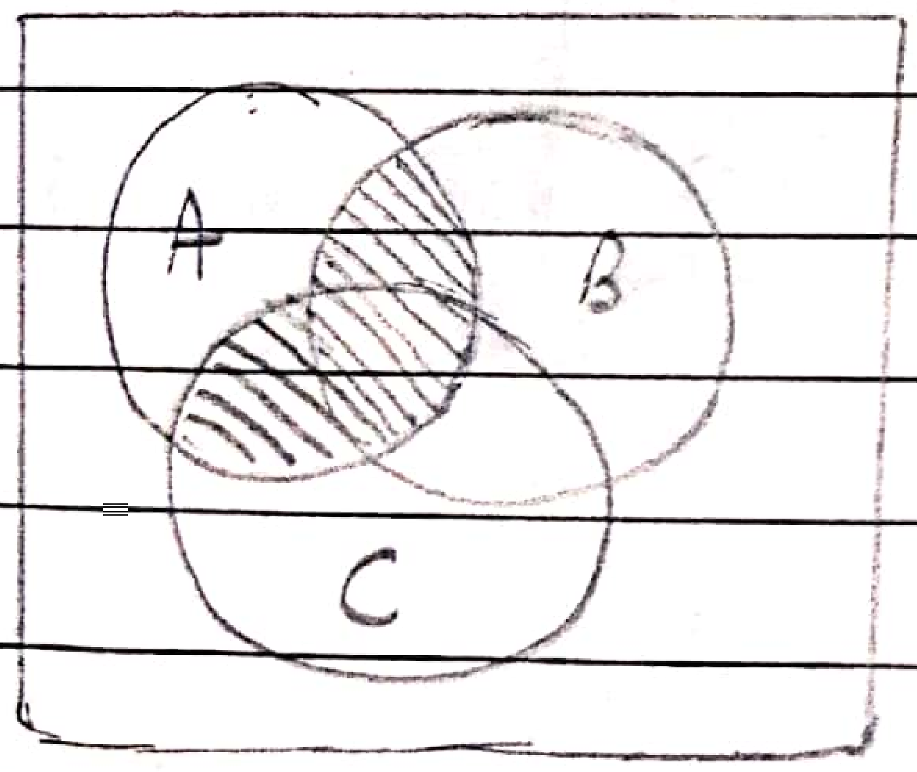
b) $A \cap B = \{a,b,c,d,e\}$

c) $A - B = \{\}$

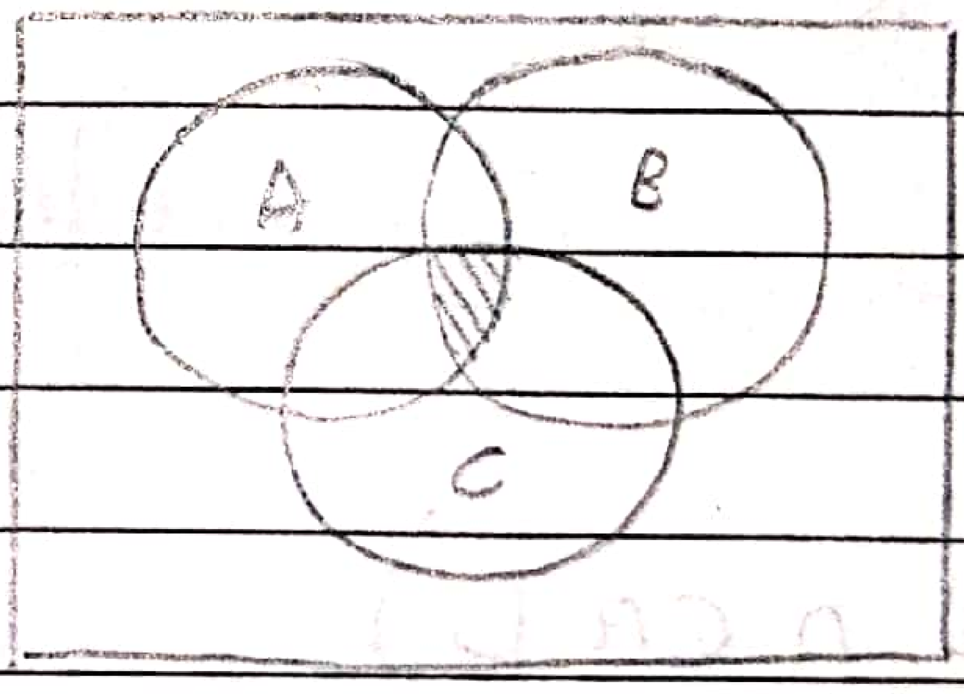
d) $B - A = \{f,g,h\}$

Q.8: venn

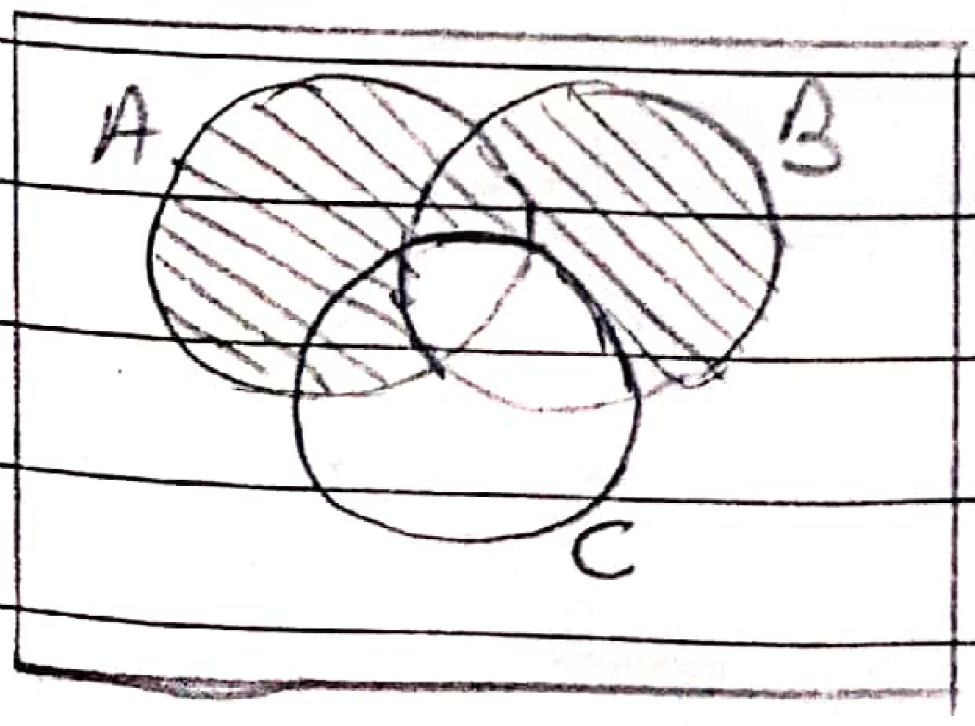
a) $A \cap (B \cup C)$



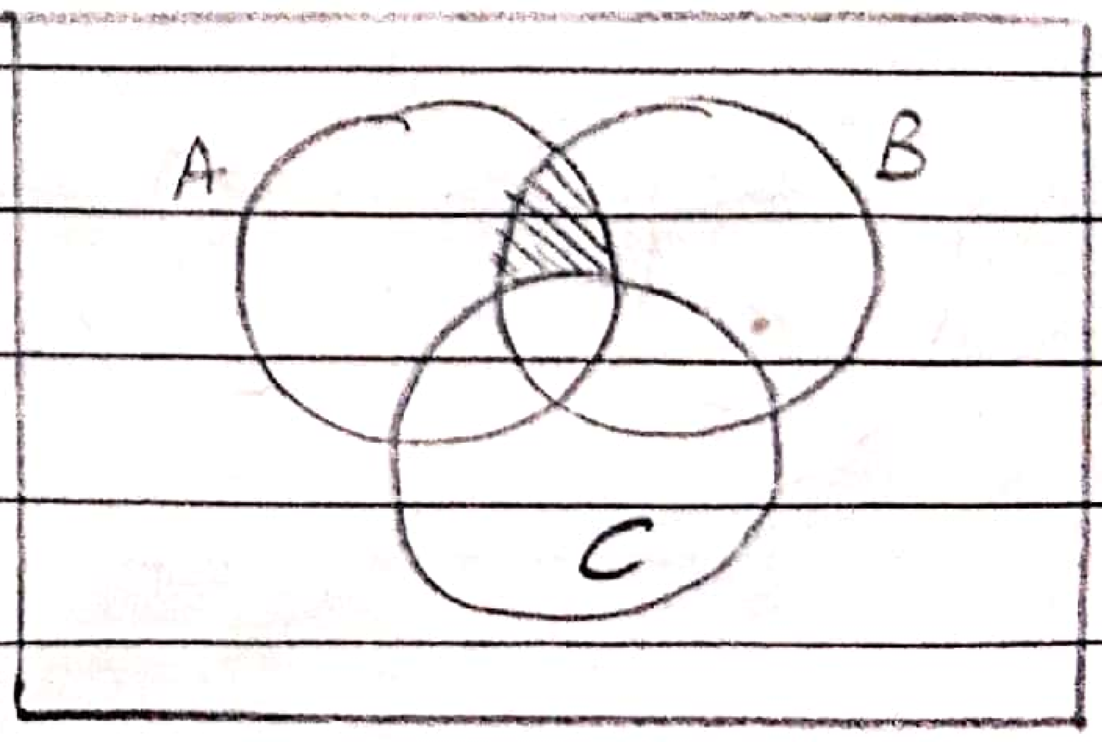
b) $A \cap B \cap C$



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



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



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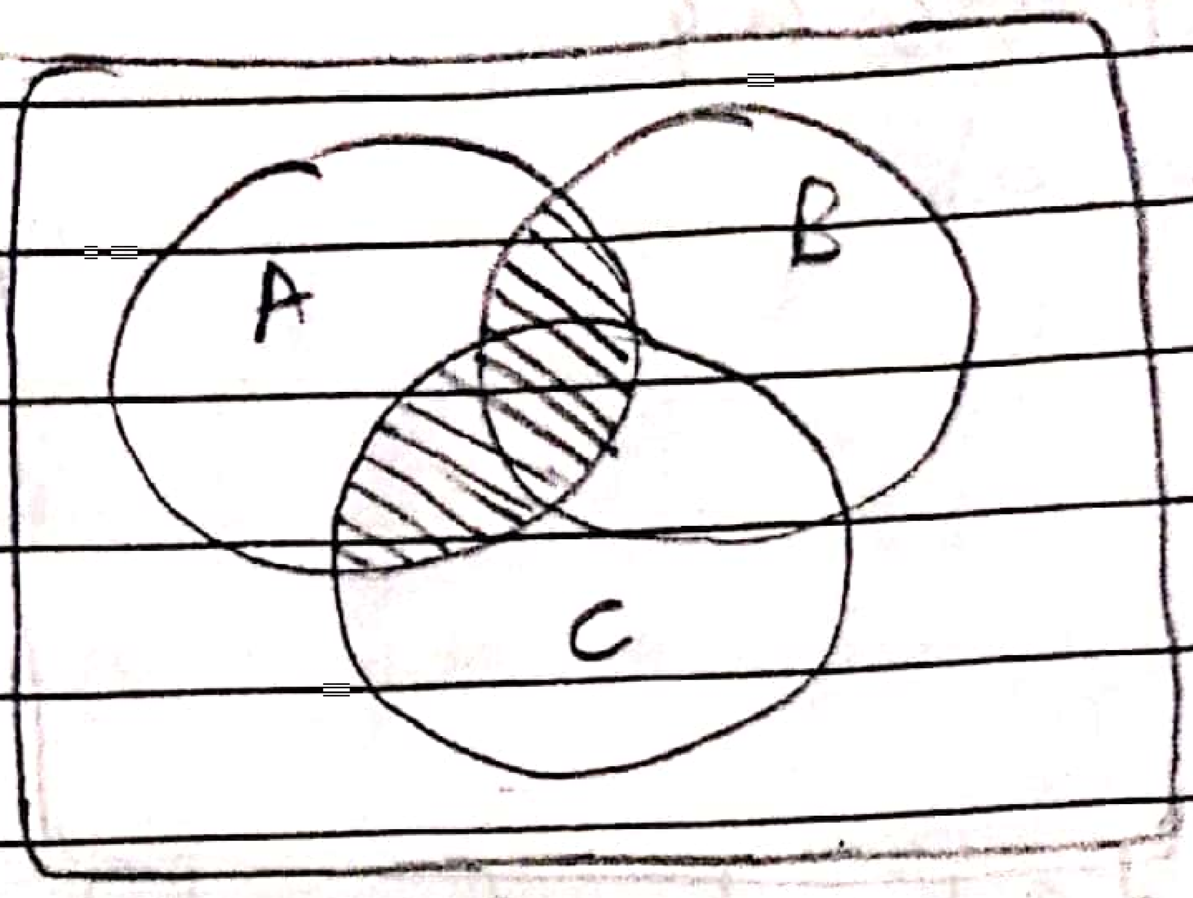
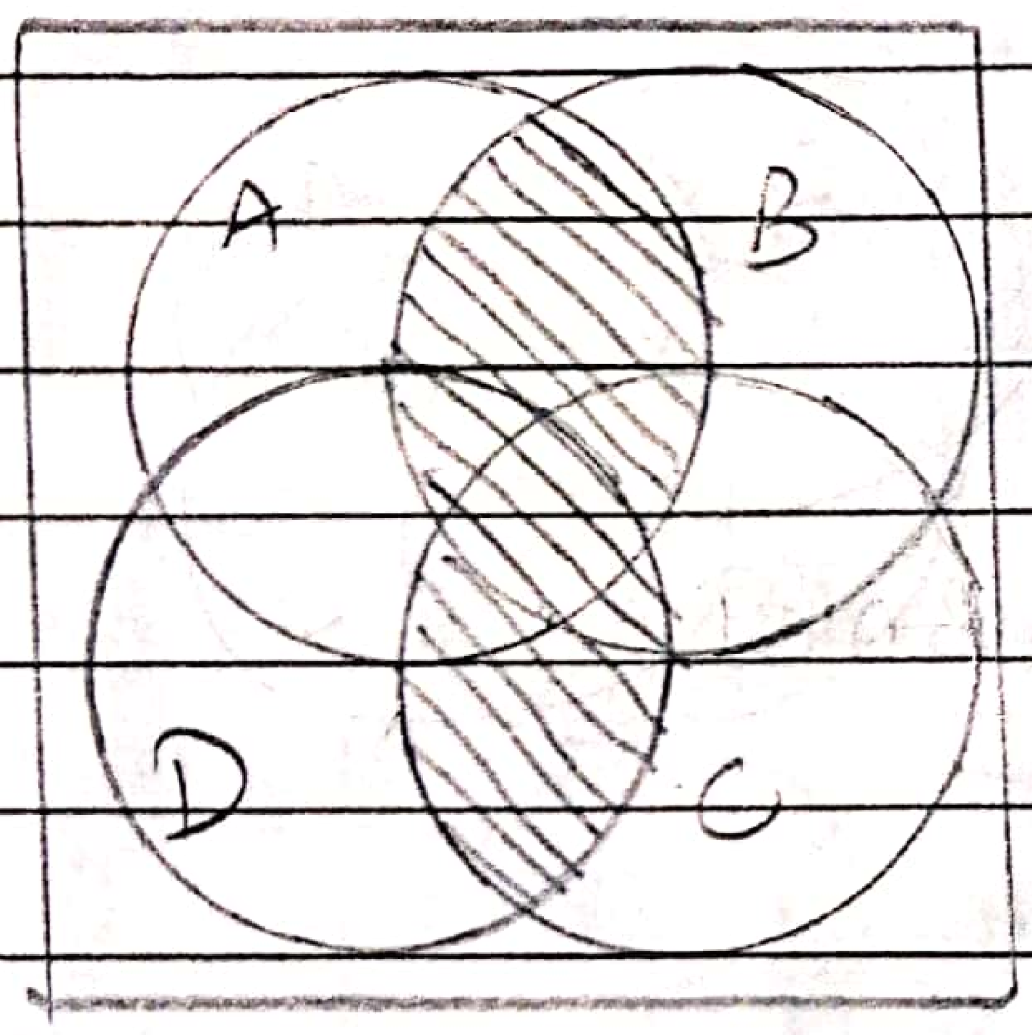
e) f) $(A \cap B) \cup (A \cap C)$

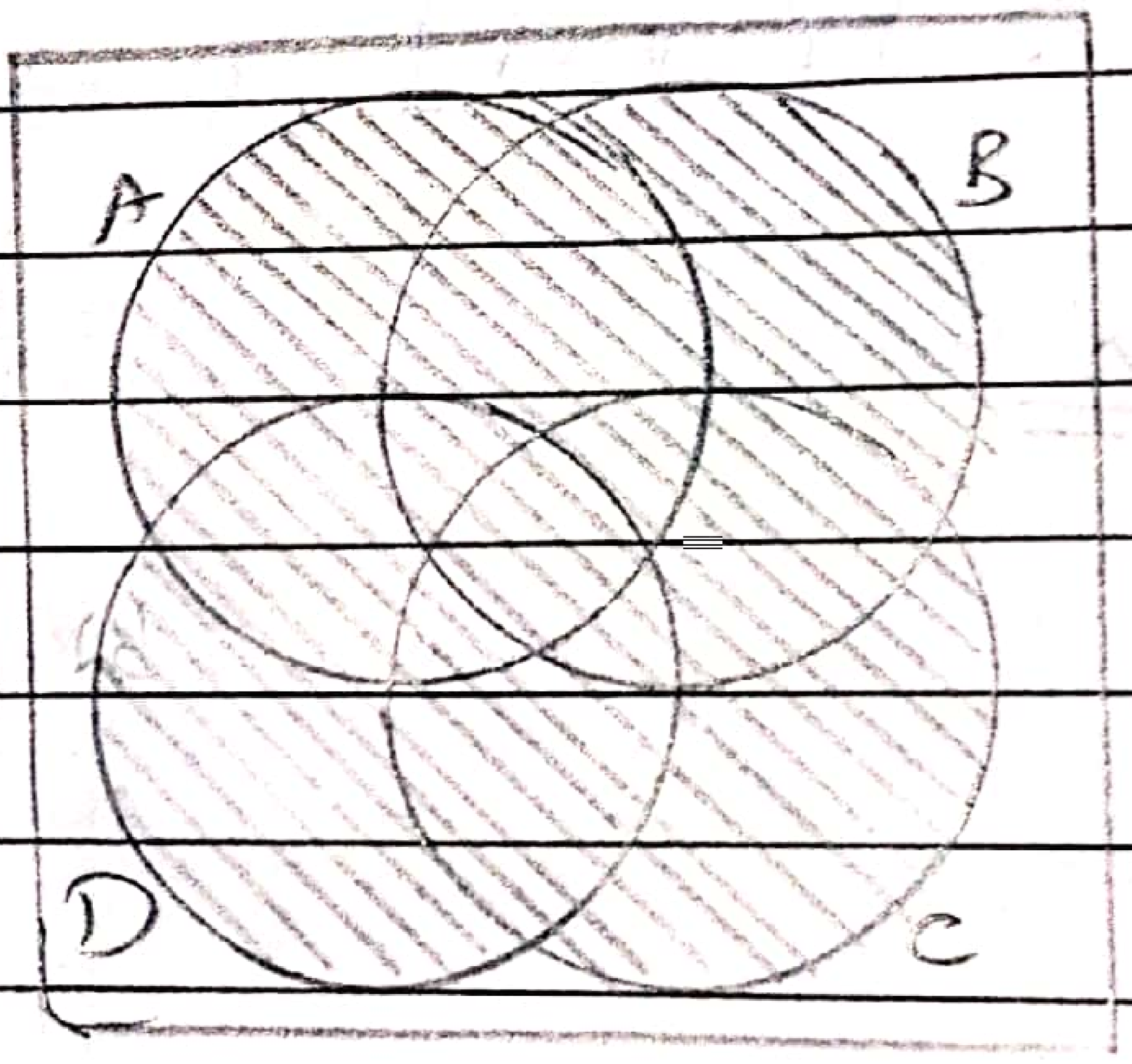


Q. 9

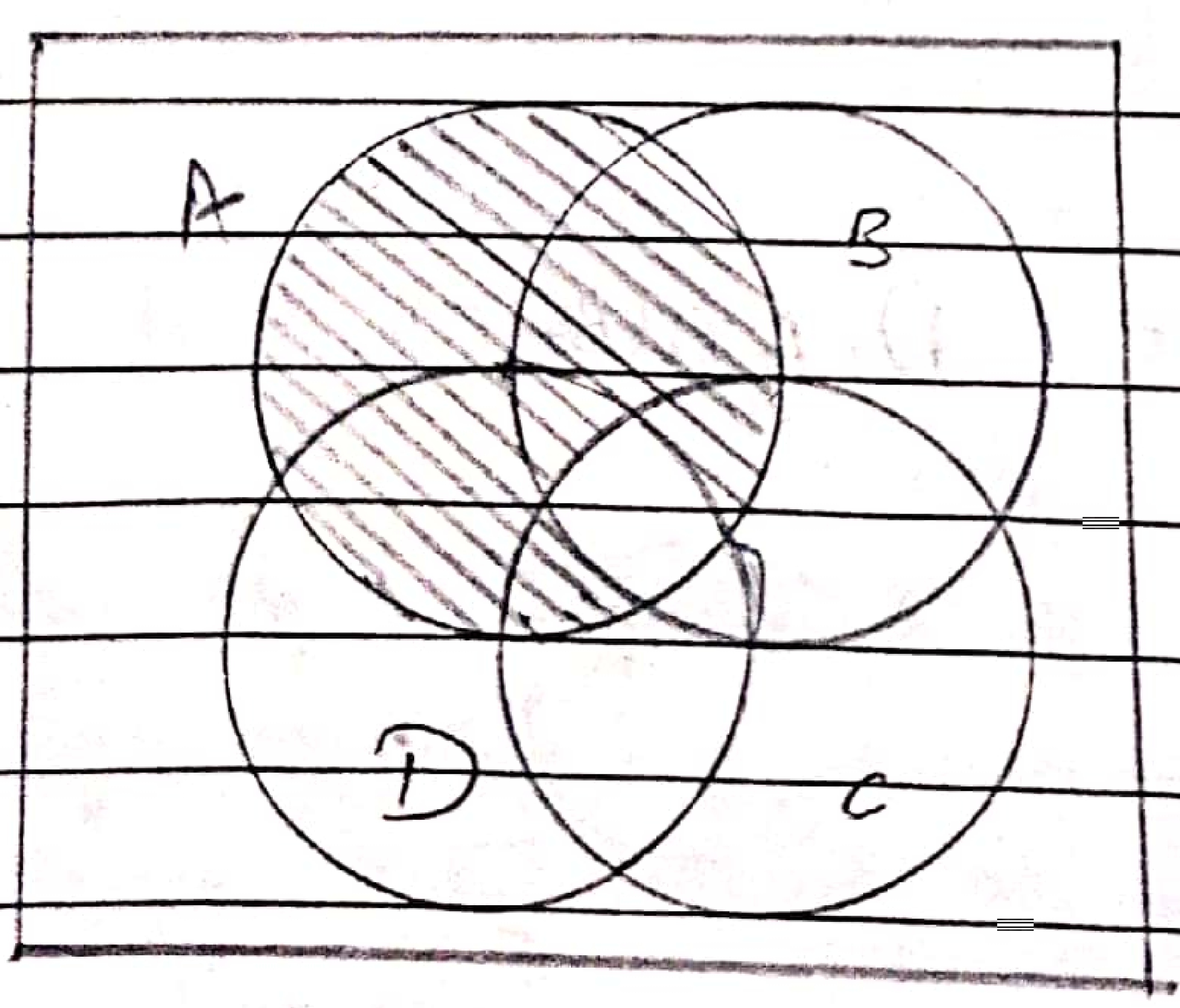
a) $(A \cap B) \cup (C \cap D)$



b) $A \cup B \cup C \cup D$



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



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Q.10:

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

Sol: let $x \in A \cup B$

Acc. to the definition of union,

$x \in A$ or $x \in B$ or in both.

Now, using addition of prepositions: $\left(\frac{p}{\therefore p \vee q}\right)$

$x \in A$ or $x \in B$ or $x \in C$

By union, $x \in A \cup B \cup C$

$\therefore$ By definition of subset $(A \cup B) \subseteq (A \cup B \cup C)$

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

Sol: let $x \in A \cap B \cap C$.

Using definition of intersection, x belongs to all of them

$\Rightarrow x \in A$ and $x \in B$ and $x \in C$.

Using simplification of prepositions $\left(\frac{p \wedge q}{\therefore p}\right)$

$x \in A$ and $x \in B$

Using definition of intersection $x \in A \cap B$

$\therefore$ by definition of subset $(A \cap B \cap C) \subseteq (A \cap B)$

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

Sol: let $x \in (A - B) - C$

Using definition of difference,

$\Rightarrow x \in A$ and $x \notin B$ and $x \notin C$

Using simplification of proposition $\left(\frac{p \wedge q}{\therefore p}\right)$

$x \in A$ and $x \notin C$.

Using definition of diff. $x \in (A - C)$

By definition of subset. $(A - B) - C \subseteq (A - C)$

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d) $(A-C) \cap (C-B) = \phi$

Sol: let $x \in (A-C) \cap (C-B)$

So, we can write by definition of intersection

$x \in (A-C)$ and $x \in (C-B)$

Now using definition of diference

$x \in A$ and $\underbrace{x \notin C \text{ and } x \in C}_{\text{cannot be True}}$ and $x \notin B$

$\Rightarrow$ $x \in A$ and False and $x \notin B$

By domination law $\Rightarrow$ False

$\therefore$ the set cannot have any element $\Rightarrow x \in \phi$

By definition of subset $(A-C) \cap (C-B) \subseteq \phi$

as we know empty set is always a subset of any set

$\phi \subseteq (A-C) \cap (C-B)$

Hence as both are subset of each other

$(A-C) \cap (C-B) = \phi$

e) $(B-A) \cup (C-A) = (B \cup C) - A$

Sol: let $x \in (B-A) \cup (C-A)$

By definition of union $x \in (B-A)$ or $x \in (C-A)$

By definition of difference

$(x \in B \wedge \neg(x \in A)) \vee (x \in C \wedge \neg(x \in A))$

By distributive law, $(x \in B \vee x \in C) \wedge \neg(x \in A)$

By definition of union, $(x \in B \cup C) \wedge \neg(x \in A)$

By definition of difference $x \in (B \cup C) - A$

Now, by definition of subset $(B-A) \cup (C-A) \subseteq (B \cup C) - A$

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for the other side.

let $x \in (B \cup C) - A$.

By definition of difference $\Rightarrow (x \in B \cup C) \wedge \neg(x \in A)$

By definition of union $\Rightarrow (x \in B$ or $x \in C)$ and $x \notin A$

By distributive law $\Rightarrow$ ~~$x \in B$~~

$\Rightarrow (x \in B$ and $x \notin A)$ or $(x \in C$ and $x \notin A)$

We can write now, $x \in (B - A)$ or $x \in (C - A)$

and by union, $x \in (B - A) \cup (C - A)$

By definition of subset $\Rightarrow$ ~~$(B - A) \cup (C - A)$~~

$(B \cup C) - A \subseteq (B - A) \cup (C - A)$

Since, both are subset of each other

$\Rightarrow \boxed{(B - A) \cup (C - A) = (B \cup C) - A}$

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Countability:

Q. 1 :

Let us consider, a one-to-one correspondence between subsets of S and bit strings (with each character either 0 or 1) of length $|S|$. A subset of S is associated with the bit string with '1' in the i^{th} position of the i^{th} element in the list in the subsets. So, by the multiplication rule, there are $2^{|S|}$ bit strings of length $|S|$.

Therefore $|P(S)| = 2^{|S|}$

A = list of bit strings of length $|S|$

P = Power set of S.

r = a subset of S is associated with a 1 in i^{th} position, if i^{th} element is in the subset.

$$A \xrightarrow{i} P$$

A	P
000	ϕ
001	{a}
010	{b}
011	~~{a, b}~~ {a, b}
100	{c}
101	{c, a}
110	{c, b}
111	{a, b, c}

$S = \{a, b, c\}$

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Q.2.

Let x and y be 2 sets having m & n elements respectively. In a function from x to y, every element from X must be mapped to an element of Y. $\Rightarrow$ each element of X has 'n' elements to choose from.

Therefore total no. of function will be

$n \times n \times \cancel{n} \times \ldots m \text{ times} = n^m$

$\Rightarrow$ Total no. of function $= \boxed{n^m}$ Ans

Q.3 Given Maths major = 18

C.S. majors = 325.

a) Using the product rule here, first event is picking a maths major and second event is picking a CS. major.

$= 18 \times 325 = \boxed{5850}$ Ans

b) Using the sum rule here, the event is picking a maths major or picking a CS major. (non overlapping) (as nobody falls in both categories).

$= 18 + 325 = \boxed{343}$ Ans

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Q.4. Given, 12 colors, 2 genders and 3 diff. sizes for each gender.

Using the product rule here, because the first event is picking the color, second event is choosing gender & third is picking the size.

$= 12 \times 2 \times 3 = 72$ ways

Q.5:

A student can choose a project by selecting one from any of the three lists. Since, no project is on more than one list, by the sum rule we can say there are $23 + 15 + 19 = 57$ ways to choose.

Q.8

Assuming on the contrary, that there is no integer in the set that divides another integer in the set.

If a is in the set such that $a \leq n$ then $2a$ cannot be in the set.

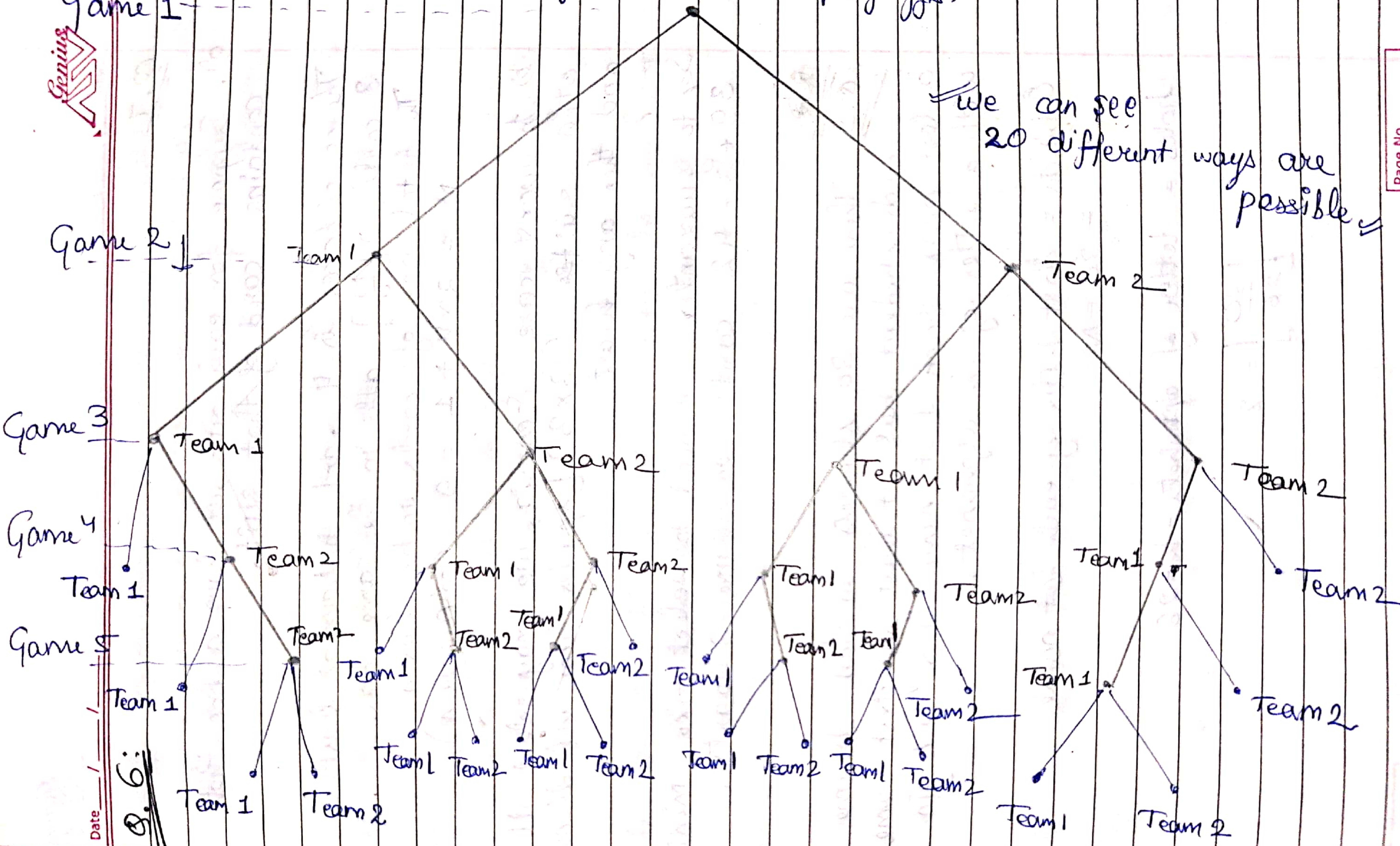
Thus, if there are k elements in the set not exceeding n, then there are k. ~~elem~~ integers greater than n+1, but less than 2n which cannot be in the set.

Thus on maximum 'n' elements can be there in the set. ~~Thus~~, ~~there~~ Contradicting the fact that S has n+1 elements.

Hence, in 'n+1' integeres, there must be an integer that ~~a~~ divides one of the other integer,s.

Q. 6:

Best out of 3 at most 5 play-offs.



We can see 20 different ways are possible

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Q.7:

a). Suppose for each suit, we have a box that contains card of that suit.

The no. of boxes is 4, and to have at least 3 cards $\Rightarrow \left\lceil \frac{N}{4} \right\rceil$ ~~atthe~~ in the same box.
The total no. of cards to be chosen.

$N = 2 \times 4 + 1 = 9$ (minimum).

b). In worst case Scenario, we may select all other suites (13x3) [spades, clubs and diamonds] and then any hearts.

So, to guarantee we need to ~~select~~ take minimum $39 + 3 = 42$ cards to ensure 3 hearts.

Q.9 There are 30 students in class. Assume that each student has at least a first name and a last name. Each last name has to begin with a letter of the alphabet.

Objects = first letter of each last name
$= 30 = N$

holes = letter of alphabets $= k = 26$

$$\left\lceil \frac{30}{26} \right\rceil = 2$$

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So, by pigeonhole principle, there are atleast two students who have a last name that begin with same letter.

Q.10:

Total 20 balls are present, half of them is red and the other half is blue.

a) The pigeonholes are the colors.
$\left\lceil \frac{x}{2} \right\rceil$ must be equal to 3 and least +ve integer satisfying the ~~integer is~~ equation is
5

b) The first 10 balls she selects could be all red, so, she needs to select minimum of 10 + 3 = 13 balls to be sure of having at least three blue balls.

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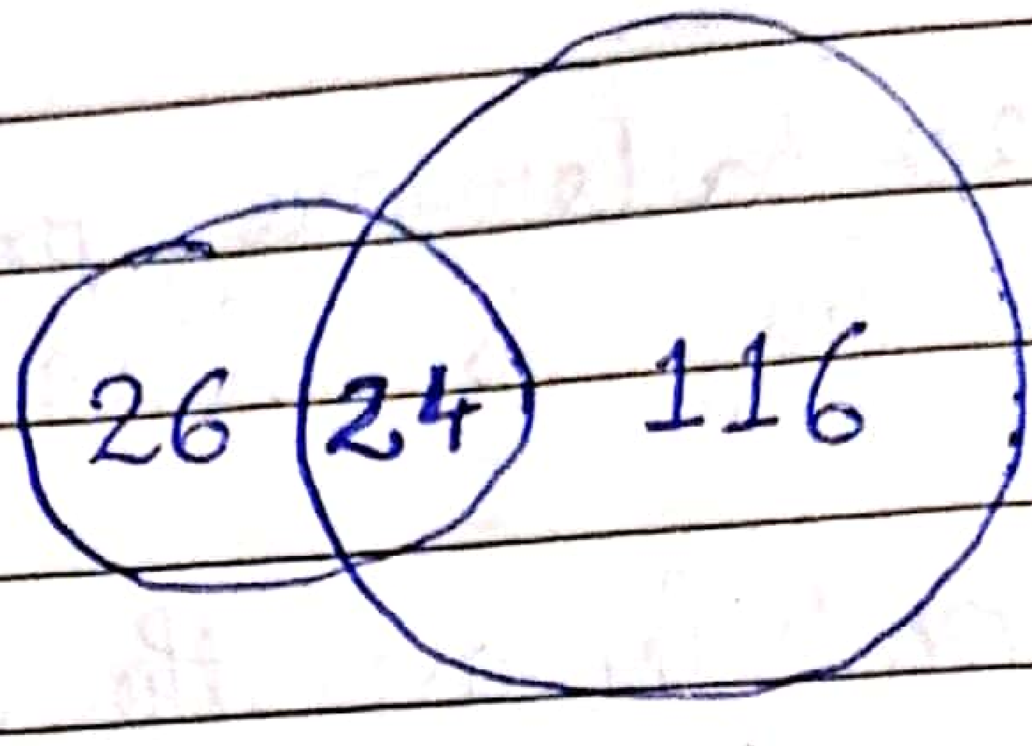
Principle of Inclusion-Exclusion

Q.1

$U = 200$
$M = 50$
$E = 140$



We know $n(M \cap E) = 24$

for ~~AU AU: MUE = M + B~~ -

$$n(M \cup E) = n(M) + n(E) - n(M \cap E)$$
$$= 166$$

Hence, people at the party will total minus ones giving exam that is ~~e/1~~ $n(\overline{M \cup E})$

$$= n(U) - n(M \cup E)$$
$$= 200 - 166$$
$$= 34 \quad \text{Ans}$$

Q.2

$n(C) = 25$
$n(M) = 13$
$n(M \cap C) = 8$

$$n(M \cup C) = n(M) + n(C) - n(M \cap C)$$
$$= 25 + 13 - 8$$
$$= 30$$

Hence, total 30 students are there.

Q.3:

$n(U) = 1807$ freshmen

$n(C) = 453$

$n(M) = 567$

$n(M \cap C) = 299$

to find $n(\overline{M \cup C}) = n(U) - n(M \cup C)$

$= 1807 - (n(M) + n(C) - n(M \cap C))$

$= 1807 - 453 - 567 + 299$

$= 2106 - 1020$

$= 1086$ Ans.

Q.4.

$n(S) = 1232$

$n(F) = 879$

$n(R) = 114$

$n(S \cap F) = 103$

$n(S \cap R) = 23$

$n(F \cap R) = 14$

$n(S \cup F \cup R) = 2092$

$n(S \cup F \cup R) = n(S) + n(F) + n(R) \cancel{- n(S \cap F)} +$

$- n(S \cap F) - n(S \cap R) - n(F \cap R)$

$+ n(S \cap F \cap R)$

$\Rightarrow n(S \cap F \cap R) = 2092 - 1232 - 879 - 114 + 103 + 23 + 14$

$= 860 - 879 + 26$

$= 886 - 879$

$= 7$ Ans

7 have taken all three

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Q.5

$n(C) = 345$

$n(M) = 212$

$n(M \cap C) = 188$

in either M or C $\Rightarrow n(M \cup C) = n(C) + n(M) - n(M \cap C)$

$= 212 + 345 - 188$

$= 557 - 188$

$= 369$ Ans

Q.6

let percentage be direct cardinalities with $n(U) = 100$

$n(TV) = 96$

$n(TP) = 98$

$n(TP \cap TV) = 95$

neither TV nor TP $\Rightarrow n(\overline{TP} \cap \overline{TV}) = n(\overline{TP \cup TV})$

$= n(U) - n(TP \cup TV)$

we have, $= 100 - (n(TP) + n(TV) - n(TP \cap TV))$

$= 100 - 96 - 98 + 95$

$= 195 - \cancel{199}\ 194$

$= 1$

1 % of households have neither TV nor TP.

Q.7 $n(A1) = 100 = n(A2) = n(A3)$

for $n(A1 \cup A2 \cup A3)$.

a) pairwise disjoint : total 300 elements.

b) 50 common pairwise, no common in all three:

$= 100\cancel{0} \times 3 - 50 \times 3 + 0$

$= 150$

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c) 50 common pairwise, 25 common in all.

$= 100\times3 - 50\times3 + 25$

$= 175$

d) Sets are equal : 100

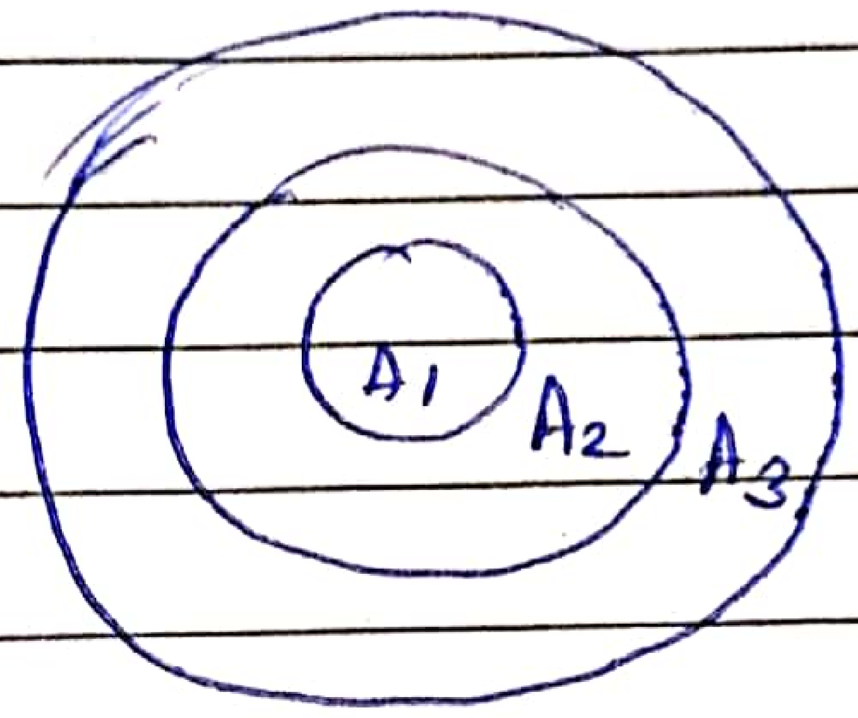
Q.8: $n(A1) = 100$

$n(A2) = 1000$

$n(A3) = 10000$

find $n(A1 \cup A2 \cup A3)$

a) $A1 \subseteq A2$ & $A2 \subseteq A3$. $\Rightarrow$



Hence,

$n(A1 \cup A2 \cup A3)$

$= 10000$

b) Pairwise disjoint : $n(A1 \cup A2 \cup A3) = n(A1) + n(A2) + n(A3)$

$= 11100$ Ans

c) 2 common pairwise, & 1 common in all 3.

$= 10000 + 1000 + 100 - 2\times3 + 1$

$= \cancel{11093}$

$= 11095$ Ans