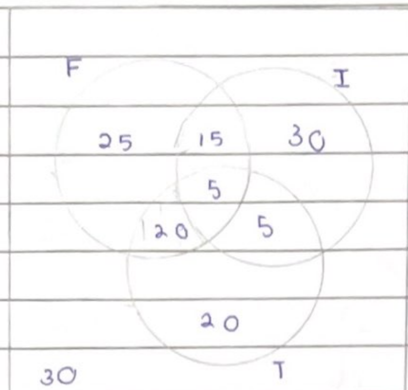
1. DAYANG FARAH FARJANA BINTI ABANG IDHAM A23CS0071
2. FARRA NURZAHIN BINTI ZAHARIL ANUAR A23CS0079
No.:
3. SAFIYA NURSYAHADAH BINTI MASNOOR A23CS0176

Question 1

a) i)



Let F : facebook users
I = Instagram users
T = Twitter users.

ii) $U = 150$

$F \cup I \cup T = 25 + 15 + 5 + 20 + 5 + 20 + 30$
$= 120$

$(F \cup I \cup T)' = U - (F \cup I \cup T)$
$= 150 - 120$
$= 30$ students

40/45

iii) $(F \cap I) + (F \cap T) + (T \cap I)$
$15 + 20 + 5 = 40$ students

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iv) $(F \cup I \cup T) - F$
$120 - (25 + 15 + 5 + 20) = 55$ students
$30 + 20 + 5 = 55$ students

No.:

b) $A = \{3, 5, 7, 9\}$

$B = \{2, 3, 5, 7\}$

$C = \{3, 6, 9\}$

i) $|A| = 4$

$|B| = 4$

$|C| = 3$

ii) subset $\rightarrow |P(A)| = 2^4$

$= 16$

proper subset $\rightarrow |P(A)| - 1$

$= 16 - 1$

$= 15$

iii) $C \times B = \{(3,2), (3,3), (3,5), (3,7)$

$(6,2), (6,3), (6,5), (6,7)$

$(9,2), (9,3), (9,5), (9,7)\}$

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No.:

Question 2

a) $\neg(p \vee q) \vee (\neg p \wedge q)$

p	q	$\neg p$	$p \vee q$	$\neg(p \vee q)$	$\neg p \wedge q$	$\neg(p \vee q) \vee (\neg p \wedge q)$
T	T	F	T	F	F	F
T	F	F	T	F	F	F
F	T	T	T	F	T	T
F	F	T	F	T	F	T

$\uparrow$ $\uparrow$

$\neg(p \vee q) \vee (\neg p \wedge q) \equiv \neg p$

$\therefore$ Based on truth table, $\neg(p \vee q) \vee (\neg p \wedge q)$ is equivalent to $\neg p$

Logic property law

$\neg(p \vee q) \vee (\neg p \wedge q)$

$= (\neg p \wedge \neg q) \vee (\neg p \wedge q)$ (De Morgan's Law)

$= \neg p \wedge (\neg q \vee q)$ (Distributive law)

$= \neg p \wedge U$ T (Complement Law)

$= \neg p$ (Identity Law)

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$\therefore$ Based on logic property, $\neg(p \vee q) \vee (\neg p \wedge q)$ is equivalent to $\neg p$

No.:

b) p = I go to the beach
q : it is a sunny summer day
r : it is sunday

i) $p \leftrightarrow r \wedge q$

ii) $\neg(r \vee q) \longrightarrow \neg p$

iii) $\neg p \longrightarrow \neg(r \vee q)$

3

c) $\forall x (x^2 + 2x - 3 = 0)$

Negation of $\forall x (x^2 + 2x - 3 = 0)$
$\sim (\forall x (x^2 + 2x - 3 = 0))$; $\exists x (x^2 + 2x - 3 \neq 0)$

let $x = 1$
$(1)^2 + 2(1) - 3 = 0$

let $x = 2$
$(2)^2 + 2(2) - 3 \neq 0$

which one

∴ statement is TRUE because it is possible to find at least one integer x number to make proposition is true

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d) Let n = students
Q = n students speak Russian
P = n students know C++

i) $\exists n (Q(n) \wedge \neg P(n))$

ii) $\forall n (Q(n) \vee P(n))$

iii) $\neg \exists n (Q(n) \vee P(n))$

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No.:

Question 3

a) if $a^2 - 3b$ is even, then a is even and b is even

~~indirect proof~~

case 1 or.

contrapositive : if $a^2 - 3b$ is odd, then a is odd and b is odd

~~$a = 2k+1$~~ let $a = 2k+1$ and $b = 2k+1$ e.

$a^2 - 3b = (2k+1)^2 - 3(2k+1)$

$= 4k^2 + 4k + 1 - 6k + 1$

$= 4k^2 - 2k + 1$ $\frac{1}{2}$.

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

$a^2 - 3b$ is odd when a is odd, b is odd

∴ case 1 is true

case 2

→ a is odd, b is even

let $a = 2k+1$ and $b = 2k$

$a^2 - 3b = (2k+1)^2 - 3(2k)$

$= 4k^2 + 4k + 1 - 6k$

$= 4k^2 - 2k + 1$

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

odd.

$a^2 - 3b$ is even when a is odd, b is even

∴ case 2 is false

2 1/2

case 3

→ a is even, b is odd

let $a = 2k$ and $b = 2k+1$

$a^2 - 3b = (2k)^2 - 3(2k+1)$

$= 4k^2 - 6k - 3$

$= 2(2k^2 - 3k) - 3$ (odd)

$a^2 - 3b$ is even when a is even and b is odd

∴ case 3 is false

e