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Assignment 1 - Chapter 1

Discrete ~~Strust~~ Structure

36.5/45

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Assignment 1 Chapter 1

1 a) U = FC students = 150 . FB & IG , $\times$ Twitter = 15

A = have only FB account = 25

B = have only IG account = 30

C = have only Twitter account = 20

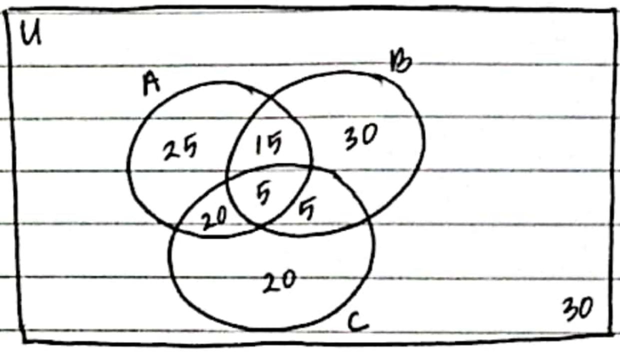
$A \cap B \cap C = 5$

FB = A = 65

IG = B = 55

Twitter = C = 50

i)



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ii) 30 students do not have an account in any of the three social networks .

iii) have exactly 2 social networks = 15 + 20 + 5

= 40

∴ 40 students have exactly 2 social networks .

iv) $A' = 30 + 5 + 20$

$= 55$

∴ 55 students have social media account other than Facebook .

b) $A = \{n \in N \mid n \text{ odd}, 1 < n < 10\}$, $N = \{\text{natural number}\}$

$B = \{n \in N \mid n \text{ is prime}, 1 < n < 10\}$

$C = \{n \in N \mid n \text{ divisible by } 3, 1 < n < 10\}$

i) $A = \{3, 5, 7, 9\}$ $|A| = 4$

$B = \{2, 3, 5, 7\}$ $|B| = 4$

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

3 3

ii) proper subsets of A : ϕ, $\{3\}$, $\{5\}$, $\{7\}$, $\{9\}$, $\{3,5\}$, $\{3,7\}$, $\{3,9\}$, $\{5,7\}$, $\{5,9\}$, $\{7,9\}$.

= 11

2 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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2. a) $\sim(p \vee q) \vee (\sim p \wedge q) \equiv \sim p$

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

The truth table shows that, $\sim(p \vee q) \vee (\sim p \wedge q) \equiv \sim p$

$\sim(p \vee q) \vee (\sim p \wedge q) \equiv (\sim p \wedge \sim q) \vee (\sim p \wedge q)$ De Morgan's laws

$\equiv \sim p \wedge (\sim q \vee q)$ Distributive laws

$\equiv \sim p \wedge T$ Negation laws

$\equiv \sim p$ (proven) Identity laws

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2. b) i) $p \rightarrow (r \wedge q)$

ii) $\neg r \vee \neg q \rightarrow \neg p$

iii) $\neg p \rightarrow \neg r \vee \neg q$

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2. c) Negation of $\forall x(x^2+2x-3=0) = \neg\forall x(x^2+2x-3=0)$

$$= \exists x \neg(x^2+2x-3=0)$$

Let $x=2$

$$x^2+2x-3 = 2^2+2(2)-3$$
$$= 5$$
$$\neq 0$$

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$\therefore \exists x \neg(x^2+2x-3=0)$ is TRUE

d) Let $R(x)$ be "x can speak Russian"

Let $C(x)$ be "x knows C++"

i) $\exists x \, (R(x) \wedge \neg C(x))$

ii) $\forall x \, (R(x) \vee C(x))$

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iii) $\neg \forall x \, (R(x) \vee C(x))$

3. a) $P(x)$: a^2-3b is even

$Q(x)$: a and b are even

$P(x) \longrightarrow Q(x) = \neg Q(x) \longrightarrow \neg P(x)$

$\neg Q(x)$: a ~~and~~ or b are odd

$\neg P(x)$: a^2-3b is odd

2.

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$a=2n+1$

$b=2m+1$

$$a^2-3b = (2n+1)^2-3(2m+1)$$
$$= 4n^2+4n+1-6m-3$$

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$a^2 - 3b = 4n^2 + 4n - 6m - 2$

$= 2(2n^2 + 2n - 3m - 1)$

$= 2t$ (where $t = 2n^2 + 2n - 3m - 1$)

$\therefore \neg Q(x) \longrightarrow \neg P(x)$ is FALSE.