UTM

UNIVERSITI TEKNOLOGI MALAYSIA

FACULTY OF COMPUTING

SEMESTER 1

2023/2024

SECI 1O13 - DISCRETE STRUCTURE

ASSIGNMENT 1 (CHAPTER 1)

SECTION 02

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Assignment 1 Chapter 1

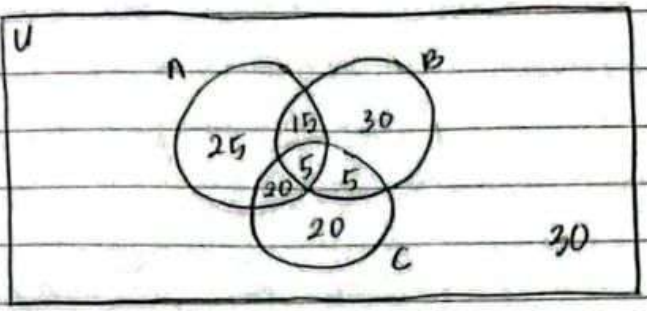
1 a) U = have an active account = 150

A = have only FB account = 25 $A \cap B = 15$ FB : 65 = A

B = have only IG account = 30 $A \cap B \cap C = 5$ IG : 55 = B

C = have only Twitter account = 20 Twit : 50 : C

i)



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

iii) 15 + 5 + 20 : 40 40 students have exactly 2 social networks

iv) A' : 30 + 5 + 20 55 students have social media other than Facebook
= 55

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

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

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

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

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

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

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

iii) $C \times B = \{(3,2), (3,3), (3,5), (3,7), (6,2), (6,3), (6,5), (6,7), (9,2), (9,3), (9,5), (9,7)\}$

Ref: Date:

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

p	q	~p	p∨q	~(p∨q)	~p∧q	~(p∨q) ∨ (~p∧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

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

b) i) $p \wedge (r \wedge q)$

ii) $(\sim r \vee \sim q) \rightarrow \sim p$

iii) $\sim p \rightarrow \sim(r \vee q)$

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 $x = 2$

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

$= 5$

$\neq 0$

$\therefore \exists x \neg(x^2+2x-3=0)$ 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) $\forall x\, R(x) \vee C(x)$

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

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

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

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

$a = 2n+1$

$b = 2m+1$

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

$= 4n^2+4n+1-6m-3$

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

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

$$= 2t \text{ (where } t = 2n^2 + 2n - 3m - 1)$$

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