UNIVERSITI TEKNOLOGI MALAYSIA

FACULTY OF COMPUTING

SEMESTER 1 2023/2024

SECI1013 – DISCRETE STRUCTURE

SECTION 3

ASSIGNMENT 1 – CHAPTER 1

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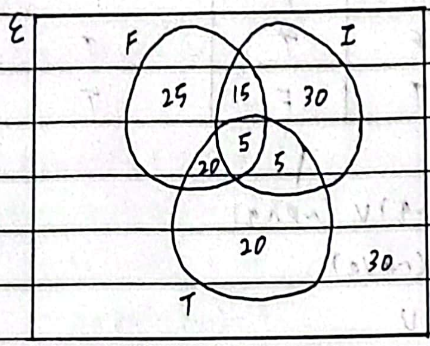
No.: .... Date: ....

Assignment 1

1. a) i) Let, F = FC students that have Facebook

T = FC students that have Twitter

I = FC students that have Instagram



ii) $150 - (25+15+5+20+5+20+30) = 30$

iii) $15+20+5 = 40$

iv) $30+5+20 = 55$

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

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

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

i) $|A| = 4$

$|B| = 4$

$|C| = 3$

ii) $|A| = 4$

$2^n = 2^4 = 16$

$16 - 1 = 15$

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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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

$$\begin{aligned} \sim(p \vee q) \vee (\sim p \wedge q) &= (\sim p \wedge \sim q) \vee (\sim p \wedge q) \\ &= \sim p \wedge (\sim q \vee q) \\ &= \sim p \wedge U \\ &= \sim p \end{aligned}$$

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

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

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

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

$\equiv \exists x (x^2 + 2x - 3 \neq 0)$

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

$\therefore$ The statement is true

d) Let, x : Student at school

p : student who can speak Russian

q : Student who knows C++

i) $\exists x (p \wedge \sim q)$

ii) $\forall x (p \vee q)$

iii) $\forall x (\sim p \wedge \sim q)$

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3. a) For all integers, if $a^2 - 3b$ is even then a is even and b is even.

$P(n) = a^2 - 3b$ is even

$Q(n) =$ a is even and b is even

Indirect proof: $P(n) \rightarrow Q(n) \equiv \sim Q(n) \rightarrow \sim P(n)$

$\sim P(n) = a^2 - 3b$ is odd

Case 1: Let a is even, b is odd

$$\begin{aligned} a^2 - 3b &= (2k)^2 - 3(2m+1) \\ &= 4k^2 - 6m - 3 \\ &= 2(2k^2 - 3m) - 3 \\ &= 2t - 3 \quad (\text{where } t = 2k^2 - 3m) \end{aligned}$$

[odd]

$\therefore a^2 - 3b$ is odd, thus $\sim P(n)$ is true.

Case 2: Let a is odd, b is even

$$\begin{aligned} a^2 - 3b &= (2m+1)^2 - 3(2k) \\ &= 4m^2 + 4m + 1 - 6k \\ &= 2(2m^2 + 2m - 3k) + 1 \\ &= 2t + 1 \quad (\text{where } t = 2m^2 + 2m - 3k) \end{aligned}$$

[odd]

$\therefore a^2 - 3b$ is odd, thus $\sim P(n)$ is true.

Case 3: Let a is odd, b is odd

$$\begin{aligned} a^2 - 3b &= (2m+1)^2 - 3(2k+1) \\ &= 4m^2 + 4m + 1 - (6k + 3) \\ &= 4m^2 + 4m - 6k - 2 \\ &= 2(2m^2 + 2m - 3k - 1) \\ &= 2t \quad (\text{where } t = 2m^2 + 2m - 3k - 1) \end{aligned}$$

[even]

$\therefore a^2 - 3b$ is even, thus $\sim P(n)$ is false

$\therefore$ When a is odd or b is odd, $a^2 - 3b$ is odd, but when a is odd and b is odd, $a^2 - 3b$ is even. Thus, the statement is false.