UTM

UNIVERSITI TEKNOLOGI MALAYSIA

FACULTY OF COMPUTING

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SECI1013 – DISCRETE STRUCTURE

SECTION 3

ASSIGNMENT 1 – CHAPTER 1

LECTURER: DR. NOR HAIZAN BT MOHAMED RADZI

STUDENT NAME	MATRIC NO
CHUA JIA LIN	A23CS0069
CHERYL CHEONG KAH VOON	A23CS0060

1.(a)(i) $U = 150$

F only = 25 $F \cap I = 15$

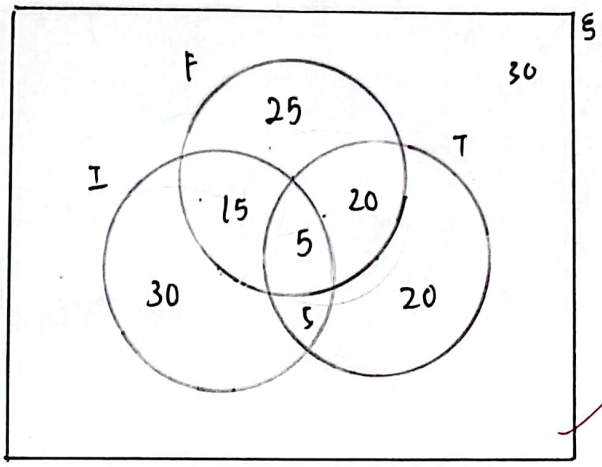
I only = 30 $F \cap I \cap T = 5$

T only = 20

F = Facebook

I = Instagram

T = Twitter



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(ii) Student does not have an account in any three sosial networks.

= 150 - 25 - 15 - 5 - 20 - 30 - 20 - 5

= 30 students

2

(iii) Student have exactly two social networks

= 15 + 20 + 5

= 40 students

2

(iv) student have social media account other than Facebook

= 30 + 5 + 20

= 55

2

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

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

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

3

(ii) $P(A) = 2^4 - 1$

$= 16 - 1$

$= 15$

3

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

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2a. Using truth table:

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

∴ ~(p∨q)∨(~p∧q) ≡ ~p (verified)

Using logic property law:

~(p∨q)∨(~p∧q) = (~p∧~q)∨(~p∧q) [De Morgan's laws]
= ~p∧(~q∨q) [Distributive laws]
= ~p∧U
= ~p

∴ ~(p∨q)∨(~p∧q) ≡ ~p (verified)

3

3

bi. (r∧q)→p

2

ii. (~r∧~q)→~p

2

iii. ~p→(~r∧~q)

2

c. Negation of ∀x(x²+2x−3=0): ~(∀x(x²+2x−3=0)) = ∃x(~(x²+2x−3=0))
∃x(~(x²+2x−3=0)) where the domain of discourse is integer.
When x=2, x²+2x−3 = (2)²+2(2)−3
= 5 (≠0)
∴ The proposition ∃x(~(x²+2x−3=0)) is TRUE.

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2d. Let $P(x)$: x is student who can speak Russian.
$Q(x)$: x is student who know C++.
where the domain of discourse consist of all students at school.

i. $\exists x(P(x) \wedge \sim Q(x))$

ii. $\forall x(P(x) \vee Q(x))$

iii. $\forall x(\sim P(x) \wedge \sim Q(x))$

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

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

$\forall x(P(x) \to Q(x))$

$P(x) \to Q(x) \equiv \sim Q(x) \to \sim P(x)$

$\sim Q(x)$ is true: - Case 1: a is odd and b is even

- Case 2: a is even and b is odd

- Case 3: a is odd and b is odd

Case 1: if a is odd and b is even, let $a=2m+1$, $b=2n$

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

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

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

$t = 2m^2+2m-3n$

$\therefore a^2-3b = 2t+1$ (odd)

$\therefore \sim Q(x)$ is true, $\sim P(x)$ is true, $\sim Q(x) \to \sim P(x)$ is true.

Case 2: if a is even and b is odd, let $a=2k$, $b=2l+1$

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

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

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

$= 2(2k^2-3l-2)+1$

$s = 2k^2-3l-2$

$\therefore a^2-3b = 2s+1$ (odd)

$\therefore \sim Q(x)$ is true, $\sim P(x)$ is true, $\sim Q(x) \to \sim P(x)$ is true.

Case 3: a is odd and b is odd, let $a=2v+1$, $b=2w+1$

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

$= 4v^2+4v+1-6w-3$

$= 2(2v^2+2v-3w-1)$

$r = 2v^2+2v-3w-1$

$\therefore a^2-3b = 2r$ (even)

$\therefore \sim Q(x)$ is true, $\sim P(x)$ is false, $\sim Q(x) \to \sim P(x)$ is false.

$\therefore$ The statement is proven false because $\sim Q(x) \to \sim P(x)$ is false in Case 3.