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Assignment 1

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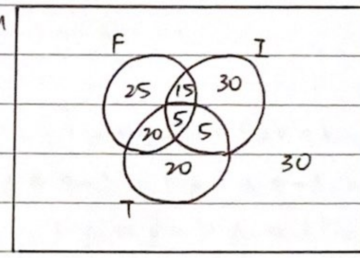
1a(i) $T = 150$ $Fb + Ig + T = 5$

Fb only $= 25$ $Fb = 65$

Ig only $= 30$ $Ig = 55$

T only $= 20$ $T = 50$

$Fb + Ig = 15$



(ii) $150 - 25 - 15 - \cancel{15}5 - 20 - 30 - 5 - 20 = 30$

(iii) $15 + 20 + 5 = 40$

(iv) $15 + 5 + 20 = 40$

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

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

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

(ii) $2^4 - 1 = 16 - 1$

$= 15$

(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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2a)

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

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

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

$= (\sim p \wedge \sim q) \vee (\sim p \wedge q)$ De Morgan

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

$= \sim p \wedge u$ Complement

$= \sim p$ Properties of universal set

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

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

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

c. $\sim (\forall x\,(x^2 + 2x - 3 = 0))$ let $x = 2$,

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

$\therefore$ The statement is TRUE.

d. let, $C(x)$ be "x is a student"

$M(x)$ be "x can speak Russian"

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

(i) $\exists x\,(M(x) \wedge \sim S(x))$

(ii) $\forall x\,(M(x) \vee S(x))$

(iii) $\forall x\,(\sim M(x) \wedge \sim S(x))$

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3. $A(n)$: $a^2 - 3b$ is even

$B(n)$: a is even and b is even

$A(n) \rightarrow B(n) \equiv \sim B(n) \rightarrow \sim A(n)$

let $\sim B(n)$ = a is odd and b is even

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

let $a = 2n+1$ $\quad (2n+1)^2 - 3(2n)$

$b = 2n$ $\quad = 4n^2 + 4n + 1 - 6n$

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

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

$\therefore$ since $\sim B(n) \rightarrow \sim A(n)$, proved TRUE.