Date: ....

Subject : SECI1013 - 01

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1. U = { 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30 }

B = { 12, 14, 16, 18, 20, 22, 24, 26, 28 }

C = { 11, 12, 13, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29 }

a) Proper Subset of C :

{ }, {11}, {12}, {13}, ... { 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29 }

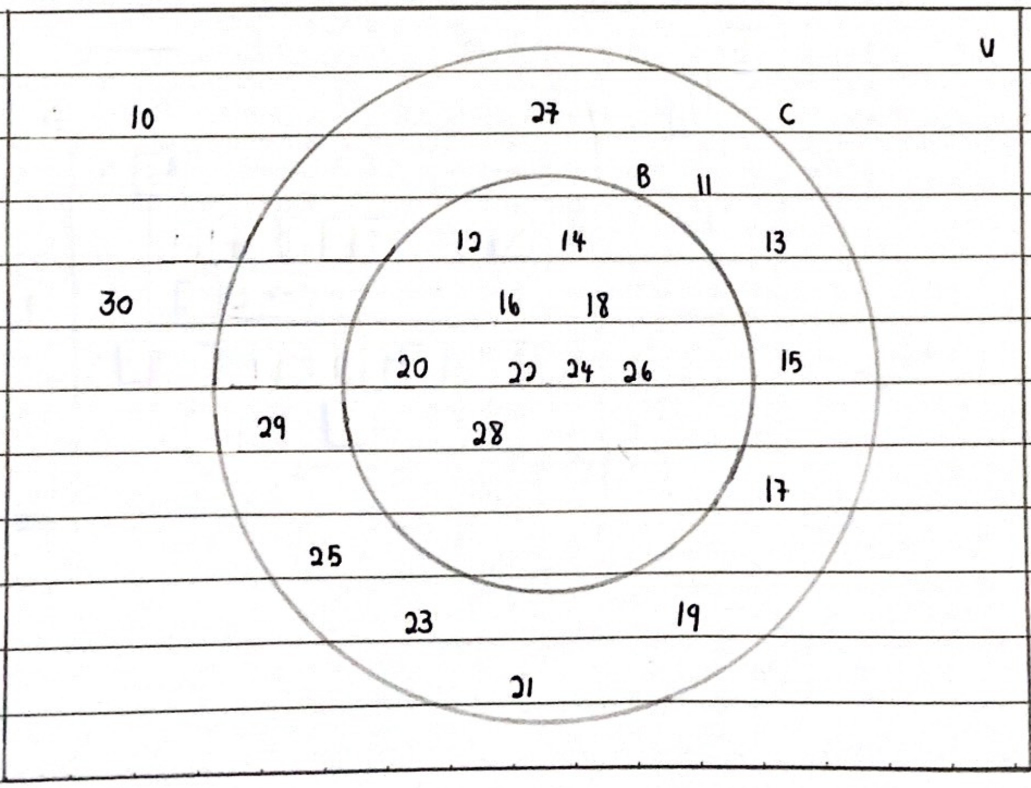
|C| = 19

b) Proper Subset of B :

{ }, {12}, {14}, {16}, ... { 14, 16, 18, 20, 22, 24, 26, 28 }

|B| = 9

c)



d) $B \oplus C = (B - C) \cup (C - B)$

$= \varnothing \cup \{11, 13, 15, 17, 19, 21, 23, 25, 27, 29\}$

$= \{11, 13, 15, 17, 19, 21, 23, 25, 27, 29\}$

$|B \oplus C| = 10$

2. $A = \{s, u, b\}$, $B = \{s, e, t\}$, $C = \{n, e, t\}$

a) $|A| = 3$ $P(A) = \{\emptyset, \{s\}, \{u\}, \{b\}, \{s, u\}, \{s, b\}, \{u, b\}, \{s, u, b\}\}$

$|P(A)| = 2^3$

$= 8$

b) $A \cup B \cap C = (A \cup B) \cap C$

$= (\{s, u, b\} \cup \{s, e, t\}) \cap \{n, e, t\}$

$= \{s, u, b, e, t\} \cap \{n, e, t\}$

$= \{e, t\}$

c) $A \cap B \cup C = (A \cap B) \cup C$

$= (\{s, u, b) \cap \{s, e, t\}) \cup \{n, e, t\}$

$= \{s\} \cup \{n, e, t\}$

$= \{s, n, e, t\}$

d) $A - B = \{u, b\}$

e) $B \times C = \{s, e, t\} \times \{n, e, t\}$

$= \{(s, n), (s, e), (s, t), (e, n), (e, e), (e, t), (t, n), (t, e), (t, t)\}$

3. a) True

b) True

c) False

d) False

e) False

4. a) $(p \rightarrow q) \wedge (\neg p \leftrightarrow \neg q)$

p	q	$\neg p$	$\neg q$	$(p \rightarrow q)$	$(\neg p \leftrightarrow \neg q)$	$(p \rightarrow q) \wedge (\neg p \leftrightarrow \neg q)$
T	T	F	F	T	T	T
T	F	F	T	F	F	F
F	T	T	F	T	F	F
F	F	T	T	T	T	T

b) $(p \leftrightarrow q) \vee (\neg p \rightarrow \neg q)$

p	q	$\neg p$	$\neg q$	$(p \leftrightarrow q)$	$(\neg p \rightarrow \neg q)$	$(p \leftrightarrow q) \vee (\neg p \rightarrow \neg q)$
T	T	F	F	T	T	T
T	F	F	T	F	T	T
F	T	T	F	F	F	F
F	F	T	T	T	T	T

5. $A = \neg p \land (\neg q \lor \neg r)$, $B = p \lor (q \land r)$, is $A \equiv B$?

p	q	r	$\neg p$	$\neg q$	$\neg r$	$(\neg q \lor \neg r)$	$(q \land r)$	$\neg p \land (\neg q \lor \neg r)$	$p \lor (q \land r)$
T	T	T	F	F	F	F	T	F	T
T	T	F	F	F	T	T	F	F	T
T	F	T	F	T	F	T	F	F	T
T	F	F	F	T	T	T	F	F	T
F	T	T	T	F	F	F	T	F	T
F	T	F	T	F	T	T	F	T	F
F	F	T	T	T	F	T	F	T	F
F	F	F	T	T	T	T	F	T	F

Since $\neg p \land (\neg q \lor \neg r) \not\equiv p \lor (q \land r)$, hence $A \not\equiv B$

6. $A = p \land (p \lor q)$, $B = p \lor (p \land q)$

p	q	$p \lor q$	$p \land q$	$p \land (p \lor q)$	$p \lor (p \land q)$
T	T	T	T	T	T
T	F	T	F	T	T
F	T	T	F	F	F
F	F	F	F	F	F

Since $p \land (p \lor q) = p \lor (p \land q)$, hence $A \equiv B$.

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7. $P(x)$: x is a student

$Q(x)$ = x is smart

$R(x)$ = x is shy

a) Some students are shy.

$\exists x \, (P(x) \rightarrow R(x))$

b) All smart people are not shy.

$\forall x \, [(\neg P(x) \rightarrow Q(x)) \rightarrow \neg R(x)]$

8. For all real numbers, if x is a negative number, then $(x)^2$ is a positive number.

Before writting the proof, we can verify the theoram by substituting x with certain values.

If $x = -2$, then $(x)^2 = 4$

If $x = -3$, then $(x)^2 = 9$

Let $P(x) = x$ is a negative number.

$Q(x) = (x)^2$ is a positive number.

$\forall x \, (P(x) \rightarrow Q(x))$

Let a be a negative real number, then

$a = -n$

$(a)^2 = (-n) \times (-n)$

$(a)^2 = (n)^2$

$(a)^2$ is a positive number.

$\therefore$ All real numbers x, if x is a negative number, then $(x)^2$ is a positive number.

9. Contradiction of $A \cap (B \cap A') = \{\}$

- Assume that $A \cap (B \cap A') \neq \{\}$
- $\exists x \in U$ such that $x \in A \cap (B \cap A')$
- This implies that there exists $x \in A$ and $x \in B \cap A'$
- From the statement $x \in B \cap A'$, we know that $x \in B$ but $x \notin A$.
- Element of $x \in A$ cannot be found in $x \in B \cap A'$.
- This is the contradiction to the hypothisis.
- Hence, $A \cap (B \cap A') = \{\}$