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SECI1013 : DISCRETE STRUCTURE

ASSIGNMENT 1 (PART 1) - CHAPTER 1

SECTION 02

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Question 1:

NOTE:

$A = \{2, 3, 5, 7, 11, 13, 17, 19\}$

$B = \{10, 12, 14, 16, 18, 20\}$

$C = \{1, 3, 5, 7, 9\}$

a. $A \cap C \cup B$

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

$= \{3, 5, 7\} \cup \{10, 12, 14, 16, 18, 20\}$

$= \{3, 5, 7, 10, 12, 14, 16, 18, 20\}$

b. $P(A \cap B \cup C)$

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

$= P(\{\} \cup C)$

$= P(C)$

Check purpose:

$|P(C)| = 2^5$

$= 32$

$P(C) = \{\emptyset, \{1\}, \{3\}, \{5\}, \{7\}, \{9\}, \{1,3\}, \{1,5\}, \{1,7\}, \{1,9\}, \{3,5\}, \{3,7\}, \{3,9\}, \{5,7\}, \{5,9\}, \{7,9\}, \{1,3,5\}, \{1,3,7\}, \{1,3,9\}, \{1,5,7\}, \{1,5,9\}, \{1,7,9\}, \{3,5,7\}, \{3,5,9\}, \{3,7,9\}, \{5,7,9\}, \{1,3,5,7\}, \{1,3,5,9\}, \{1,3,7,9\}, \{1,5,7,9\}, \{3,5,7,9\}, \{1,3,5,7,9\}\}$

c. $A - C$

$= \{2, 11, 13, 17, 19\}$

d. $|A| = 8$, $|B| = 6$, $|C| = 5$

e. $|P(A \cap C)|$

$= 2^3$

$= 8$

f. $B \subset C'$

$C' = \{0, 2, 4, 6, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20\}$

All elements of B inside C' but not equal to C'

= True

g. $(A \cup B \cup C) \subseteq U$

$(A \cup B \cup C) = \{1, 2, 3, 5, 7, 9, 10, 11, 12, 13, 14, 16, 17, 18, 19, 20\}$

= True

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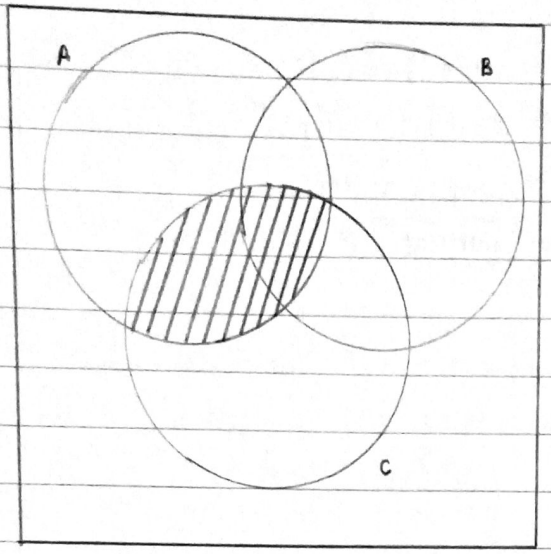
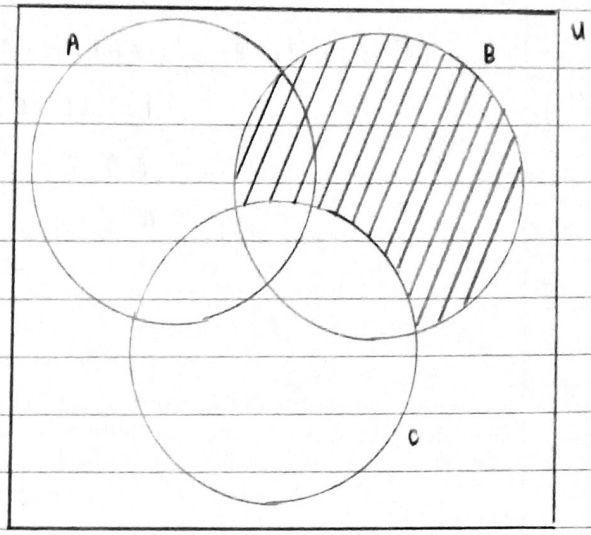
2) a) $(A-C') \cup (B-C) = A \cup B$

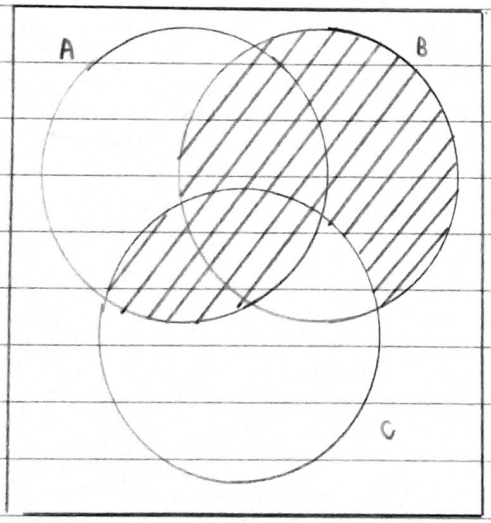


$A - C'$



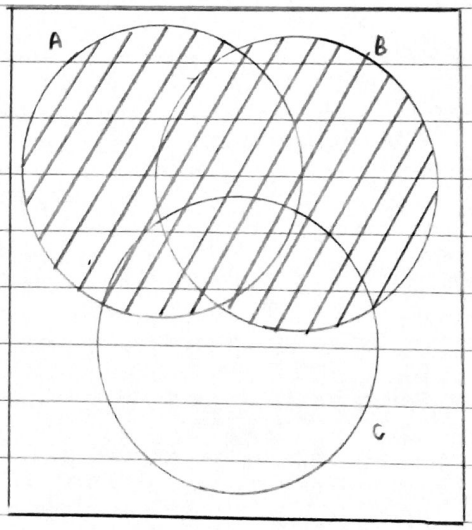
$B - C$

Hence,



$(A-C') \cup (B-C)$

$\neq$



$B \cup C$

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

$(A \cap B) \cup (A - B) = (A \cap B) \cup (A \cap B')$ → set difference law

$= A \cap (B \cup B')$ → distributive law

$= A \cap U$ → complement law

$= A$ → properties of universal set

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3) a) $S = \{a, b, c, d, e, f, g\}$

$T = \{h, j, k, l, m, n, p, q\}$

$E = \{p, q, r, s, t, v, w, y, z\}$

b) $S \times (T \cap E)$

$T \cap E = \{p, q\}$

$= \{a, b, c, d, e, f, g\} \times \{p, q\}$

$= \{(a,p), (b,p), (c,p), (d,p), (e,p), (f,p), (g,p), (a,q), (b,q), (c,q), (d,q), (e,q), (f,q), (g,q)\}$

4) a) TRUE

b) TRUE

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5) a. $Q = (p \wedge r) \vee (q \vee \neg r)$, $R = (p \vee q) \vee \neg r$

p	q	r	$(p \wedge r)$	$\neg r$	$(q \vee \neg r)$	$(p \wedge r) \vee (q \vee \neg r)$	$(p \vee q)$	$(p \vee q) \vee \neg r$
T	T	T	T	F	T	T	T	T
T	T	F	F	T	T	T	T	T
T	F	T	T	F	F	T	T	T
T	F	F	F	T	T	T	T	T
F	T	T	F	F	T	T	T	T
F	T	F	F	T	T	T	T	T
F	F	T	F	F	F	F	F	F
F	F	F	F	T	T	T	F	T

$\therefore Q = R$

b. $Q = (p \wedge r) \vee \neg (p \wedge \neg q)$, $R = (p \wedge r) \rightarrow (q \vee r)$

p	q	r	$p \wedge r$	$\neg q$	$p \wedge \neg q$	$\neg (p \wedge \neg q)$	Q	$q \vee r$	R
T	T	T	T	F	F	T	T	T	T
T	T	F	F	F	F	T	T	T	T
T	F	T	T	T	T	F	T	T	T
T	F	F	F	T	T	F	F	F	T
F	T	T	F	F	F	T	T	T	T
F	T	F	F	F	F	T	T	T	T
F	F	T	F	T	F	T	T	T	T
F	F	F	F	T	F	T	T	F	T

$\therefore Q \neq R$

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6. D = {1, 3, 5, 7, 8, 9}

a) - when x = 9, x is not even but is greater than 7, hence the statement produce false value.
- Thus, above statement is false and the counter example is 9.

b) - when x = 8, x is even and greater than 7, hence the statement produce false value.
- Thus, above statement is false and the counterexample is 8.

7. P(x): "x can speak Arabic"
Q(x): "x knows computer language C++"
Domain of quantifiers: All students at faculty
There is a student at faculty who can speak Arabic and knows C++.

$$\exists x\,(P(x) \wedge Q(x))$$

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8) $q^2 - 3q$

Let $q = 2n+1$

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

$= (2n+1)(2n+1) - 6n - 3$

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

$= 4n^2 - 2n - 2$

$= 2(2n^2 - n - 1)$ → Let $2n^2 - n - 1 = m$

$= 2m$

Hence, multiple of 2 is even integer.

9) contradiction : suppose n^2 is odd an n is not odd.

n^2 is odd and n is even.

Let $n = 2a$

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

$= 4a^2$ (even)

- Hence, n^2 is even, n is even
- Contradiction
- n^2 is odd and n is odd.
- Therefore, we conclude that statement is true.