DISCRETE STRUCTURE (SECI 1013-03)

SEMESTER 1-2020/2021

ASSIGNMENT# 1

GROUP 5


**GROUP MEMBERS:**

| NAME | MATRIC NO. |
|---|---|
| 1. KELVIN EE | A20EC0195 |
| 2. LEE CAI XUAN | A20EC0062 |
| 3. RASMIN KAUR SANDHU | A19ET0216 |

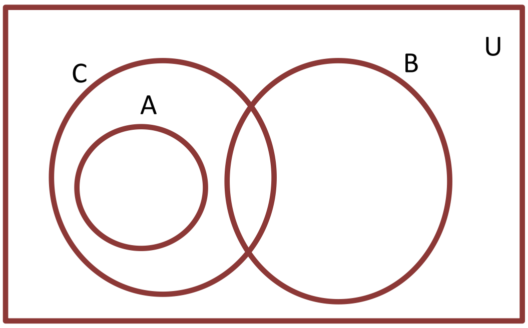
**LECTURER'S NAME:**

DR. NOR AZIZAH BINTI ALI

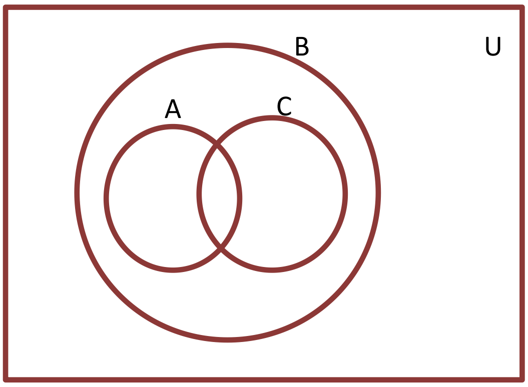
1) $A = \{1,2\}$
   $B = \{1, 2, 3\}$
   $C = \{3, 4, 5, 6, 7, 8\}$

   a) $A \cup C = \{ 1, 2, 3, 4, 5, 6, 7, 8\}$
      $= \{ x \in R \mid 1 \leq x \leq 9 \}$
   b) $(A \cup B)' = \{ x \in R \mid x < 1, x \geq 4\}$
   c) $A' \cup B' = \{ x \in R \mid \{ x \in R \mid x < 1, x \geq 3\}\}$

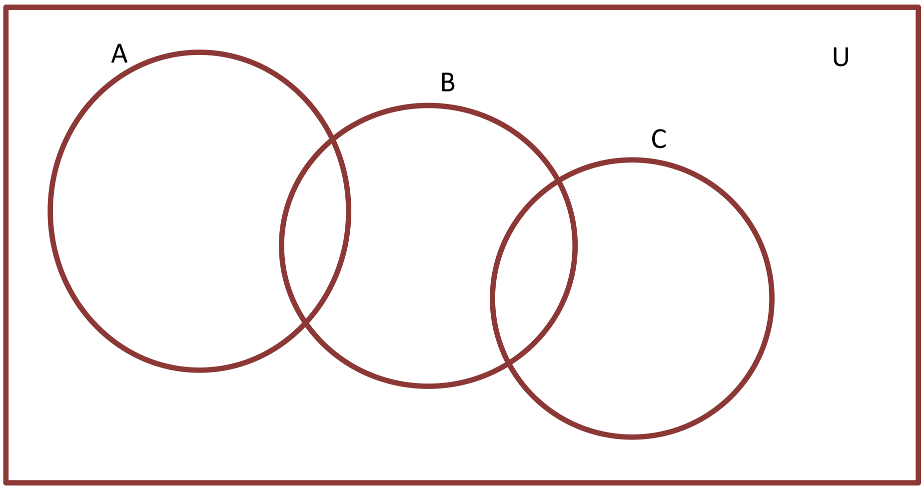
2) a) $A \cap B = \emptyset$, $A \subseteq C$, $C \cap B \neq \emptyset$




b) $A \subseteq B$, $C \subseteq B$, $A \cap C \neq \emptyset$




c) $A \cap B \neq \emptyset$, $B \cap C \neq \emptyset$, $A \cap C = \emptyset$, $A \not\subset B$, $C \not\subset B$



3) A x B = {(-1,1), (-1, 2), (1, 1), (1, 2), (2, 1), (2, 2), (4, 1),(4, 2) }
S = {(-1, 1), (1, 1), (2, 2)}
T = {(1, 1), (2, 2),(4, 2)}
S ∩ T = {(1,1), (2,2)}
S ∪ T = {(-1,1), (1,1), (2,2),(4,2)}

4) $\neg((\neg p \wedge q) \vee (\neg p \wedge \neg q)) \vee (p \wedge q) \equiv p$

| | |
|---|---|
| $\neg((\neg p\wedge q) \vee (\neg p\wedge\neg q)) \vee (p\wedge q)$ | |
| $= (\neg(\neg p\wedge q) \ \wedge\ \neg(\neg p\wedge\neg q)) \vee (p\wedge q)$ | , De Morgan's Law |
| $= (\neg(\neg p) \vee\neg q) \ \wedge\ (\neg(\neg p) \vee \neg(\neg q)) \vee (p\wedge q)$ | , De Morgan's Law |
| $= ( ( p \vee \neg q) \wedge ( p \vee q) ) \vee (p\wedge q)$ | , Double Negation Law |
| $= (p\wedge q) \vee ( ( p \vee \neg q) \wedge ( p \vee q) )$ | , Commutative Law |
| $= ((p\wedge q) \vee( p \vee \neg q)) \wedge ((p\wedge q) \vee( p \vee q))$ | , Distributive Law |
| $= ( ((p\wedge q)\vee p) \vee \neg q) \wedge ( ((p\wedge q) \vee p) \vee q))$ | , Associative Law |
| $= (p \vee \neg q) \wedge ( p \vee q)$ | , Absorption Law |
| $= p \vee ( q \wedge \neg q)$ | , Distributive Law |
| $= p$ | , Negation Law |

5) a)

$$A_1 = \begin{bmatrix} 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 0 \\ 1 & 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 \end{bmatrix}$$

b)

$$A_2 = \begin{bmatrix} 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 & 0 \\ 1 & 1 & 1 & 0 & 0 \\ 1 & 1 & 1 & 1 & 0 \end{bmatrix}$$

c) $M_{A_1} = \begin{bmatrix} 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 0 \\ 1 & 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 \end{bmatrix}$

Reflexive: Since for each x ∈ A, (x,x) ∉ R, thus R is **not a reflexive relation.**

Symmetric: Since all x,y ∈ A, if (x,y) ∈ R, then (y,x) ∈ R,so it is **symmetric**.

Transitive: Mr x Mr is not equal to Mr , thus R **is not transitive.**

So, R is not equivalence relation.

d) $M_{A_2} = \begin{bmatrix} 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 & 0 \\ 1 & 1 & 1 & 0 & 0 \\ 1 & 1 & 1 & 1 & 0 \end{bmatrix}$

Reflexive: Since for each x ∈ A, (x,x) ∉ R, thus R is **irreflexive relation.**

Symmetric: Since for all a, b∈ A, (a, b) ∈R but (b, a) ∉ R, thus R **is antisymmetric**.

Transitive: Mr x Mr is not equal to Mr , thus R is **not transitive**..

So, R is not partial order relation.

6)

a. R1∪ R2 = $\begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 0 & 1 \end{bmatrix}$

b. R1∩ R2 = $\begin{bmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}$

7) The domain and codomain of all functions in this question f, g, and f+g are specified in the question to be the set of real numbers. If f(x)=f(x)=x and g(x)=−x then the

range of the function f+g is {0}. Therefore the function f+g is not one to one since all the domain will mapped to the same point of codomain

Let us assume that f(x)=x and g(x)= -x

$$(f+g)(x): f(x)+g(x)$$
$$: x+(-x)$$

Trial and error; $(f+g)(3)=3+(-3)=0$

$$(f+g)(4)=4+(-4)=0$$

This shows $x_1 \neq x_2$ but with $(f+g)(3)=(f+g)(4)$.

Thus, $f+g$ is not one-to-one function.

8) Let n = 1, c1 = 1
Let n = 2, c2 = 2

Since the number of ways is depends on the last two steps which is (n-1) and (n-2), for n≥3, $c_n = c_{n-1} + c_{n-2}$

For n = 3, if first steps = 1 , c=2     1, 1, 1,   1 , 2
If first steps = 2, c=1     2, 1

c3 = c2 +c1
=3

9)

a. $t_n = t_{n-1} + t_{n-2} + t_{n-3}$ for all n $\geq 3$
$t_7 = t_6 + t_5 + t_4$
$t_7 = 24$

b. Input : n
Output: f (n)
f (n) {
Return f (n-1) + f (n-2)
}