UNIVERSITI TEKNOLOGI MALAYSIA

SECI1013-07 DISCRETE STRUCTURE

GROUP ASSIGNMENT I

SEMESTER 1, SECI1013 2020/2021

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Answer to the Question No-1

$A = \{x \in \mathbb{R} \mid 0 < x \leq 2\}$
$A = \{1, 2\}$

$B = \{x \in R \mid 1 \leq x < 4\}$
$B = \{1, 2, 3\}$

$C = \{x \in \mathbb{R} \mid 3 \leq x < 9\}$
$C = \{3, 4, 5, 6, 7, 8\}$

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

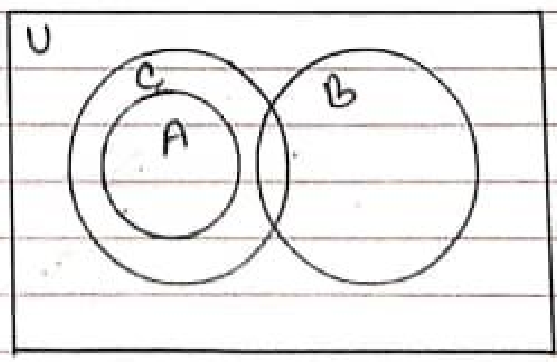
b) $(A \cup B)' = \{4, 5, 6, 7, 8\}$

c) $A' \cup B' = \{3, 4, 5, 6, 7, 8\}$

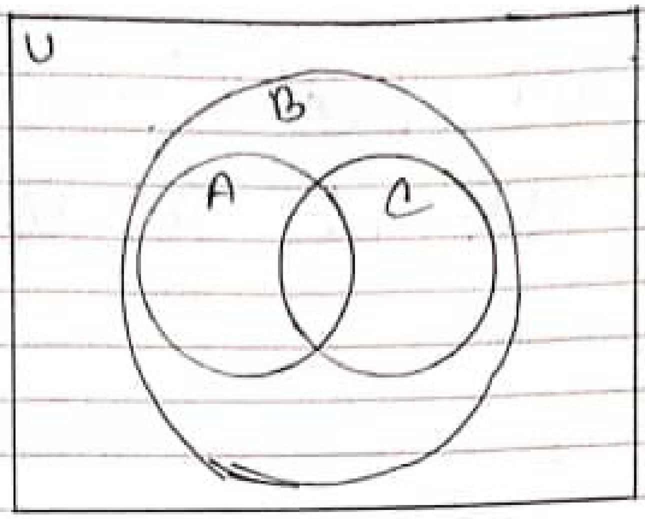
Answer to the Question No - 2

U = Universal set

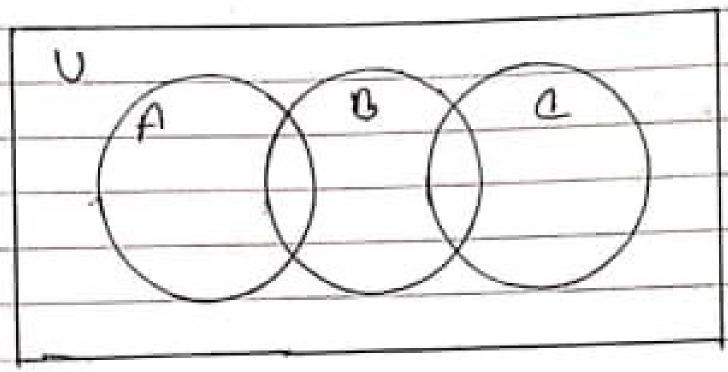
a)



b)



c)



Answer to the Question No. 3

$A \times B = \{(-1,1), (-1,2), (1,1), (1,2), (2,1), (2,2), (4,1), (4,2)\}$

$S = \{(-1,1), (1,1), (2,2)\}$

$T = \{(-1,1), (1,1), (2,2), (4,2)\}$

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$S \cap T = \{(-1,1), (1,1), (2,2)\}$

$S \cup T = \{(-1,1), (1,1), (2,2), (4,2)\}$.

Ans-to-the-Ques-No: 4

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

$= (\neg\neg p \vee \neg q) \wedge (\neg\neg p \vee \neg\neg q) \vee (p \wedge q)$ (De Morgan's law)

$= (p \vee \neg q) \wedge (p \vee q) \vee (p \wedge q)$ (double negation law)

$= (p \vee (\neg q \wedge q)) \vee (p \wedge q)$ (distributive law)

$= (p \vee F) \vee (p \wedge q)$ (negation law)

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

$= p$ (absorption law)

Therefore, shown, $\neg((\neg p \wedge q) \vee (\neg p \wedge \neg q)) \vee (p \wedge q) \equiv p$

Ans-to-the-Ques-No:- 5

(a) $R1 = \{(1,1), (12), (1.3), (1,4), (1,5), (2,1), (2,2), (2,3), (2,4), (3,1), (3,2), (3,3), (4,1), (4,2), (5,1)\}$.

$$A1 = \begin{matrix} 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 0 \\ 1 & 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 \end{matrix}$$

(b) $R2 = \{(2,1), (3,1), (3,2), (4,1), (4,2), (4,3), (5,1), (5,2), (5,3), (5,4)\}$

$$A2 = \begin{matrix} 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 & 0 \\ 1 & 1 & 1 & 0 & 0 \\ 1 & 1 & 1 & 1 & 0 \end{matrix}$$

(c) not reflexive
symmetric
not transitive

So, since equivalence relation must be symmetric, reflexive, and transitive R1 is not an equivalence relation.

(d) not symmetric
not transitive
not reflexive.

Since, partial order relation must be antisymmetric, reflexive and transitive R2 is not a partial order relation.

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Ans to the Ques No :- 6

$R1 = \{(1,1), (2,2), (2,3), (3,1), (3,3)\}$

$R2 = \{(1,2), (2,2), (3,1), (3,3\}$

(a) $R1 \cup R2 = \{(1,1), (1,2), (2,2), (2,3), (3,1), (3,3)\}$

(b) $R1 \cap R2 = \{(2,2), (3,1), (3,3)\}$.

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7. Answer:

If one-to-one function, $x_1 = x_2$

$f(x_1) = f(x_2)$

$g(x_1) = g(x_2)$

$f+g(x_1) = x_1 + x_1 = 2x_1$

$f+g(x_2) = x_2 + x_2 = 2x_2$

$2x_1 = 2x_2$

$x_1 = x_2$

Thus, $f+g$ is also one-to-one function because it has its own image.

8. Answer:

if $n=1$, there is only 1 way to climb the stair at a time.
if $n=2$, there are only 2 ways to climb the stair at a time.
thus, $n=3$, we need to take combination of one- or two-stair increments.

$\therefore$ $C_n = C_{n-1} + C_{n-2}$, $n \geq 3$ with initial condition $C_1 = 1, C_2 = 2$

C_n = number of different ways to climb the staircase.

n = number of stairs

Example

$C_3 = 2 + 1 = 3$

$C_4 = 3 + 2 = 5$

$C_5 = 5 + 3 = 8$

To proof this relation is correct, we take $C_5 = 8$ as example, if there are 8 different ways to climb 5 stairs.

1 2 3 4 5 6 7 8

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9) $t_0=0,\ t_1=t_2=1,\ t_n=t_{n-1}+t_{n-2}+t_{n-3},\ n\geq 3$

Answer:

a) Find t_7

$t_3=t_0+t_1+t_2=0+1+1=2$

$t_4=t_1+t_2+t_3=1+1+2=4$

$t_5=t_2+t_3+t_4=1+2+4=7$

$t_6=t_3+t_4+t_5=2+4+7=13$

$t_7=t_4+t_5+t_6=4+7+13=24$ #

b)
```
f(n){
  if(n=0)
     return 0
  if(n=1 or n=2)
     return 1
     return f(n-1)+f(n-2)+f(n-3) }
```
*(Input: n , Output: f(n))