Semester 2020/2021

Subject : Discrete Structure SECI1013

Section : 07

Task : Assignment 1

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Group Number:14

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Solution to the question no (1)

a)

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

$= \{1, 2\}$

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

$= \{1, 2, 3\}$

$C = \{x \in R \mid 3 \leq x < 9\}$

$= \{3, 4, 5, 6, 7, 8\}$

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

(b)

here,

$(A \cup B) = \{1, 2, 3\}$

$= \{x \in R \mid 0 < x \leq 2 \text{ or } 1 \leq x < 4\}$

$= \{x \in R \mid 0 < x < 4\}$

$(A \cup B)' = R - (A \cup B)$

$= \{x \in R \mid 0 \geq x \text{ or } x \geq 4\}$

c.

$A' \cup B'$

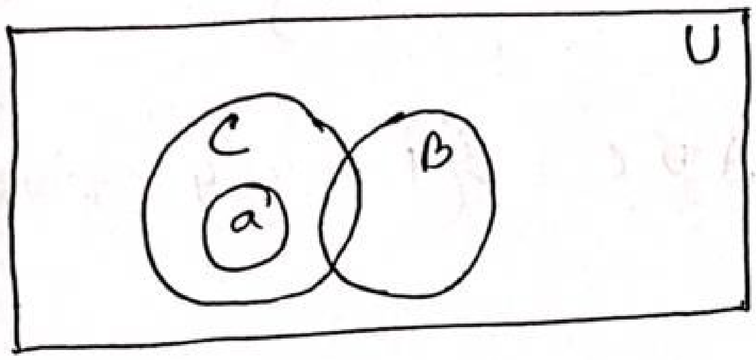
$A' = \{x \in R \mid 0 \geq x > 2\}$

$B' = \{x \in R \mid 1 > x \geq 4\}$

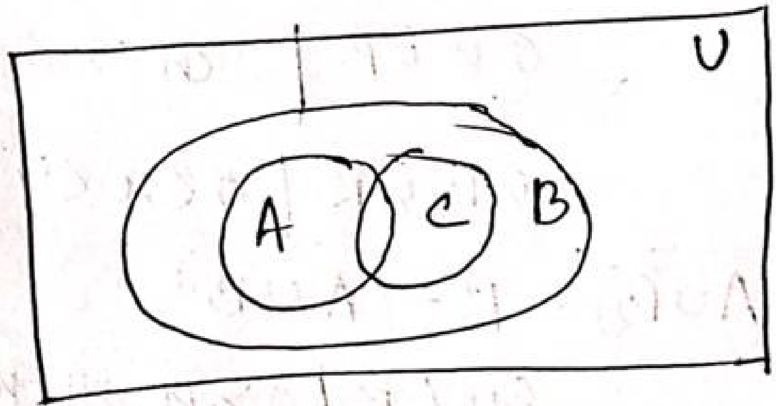
$A' \cup B' = \{x \in R \mid 0 \geq x \text{ or } x > 2\}$.

2.

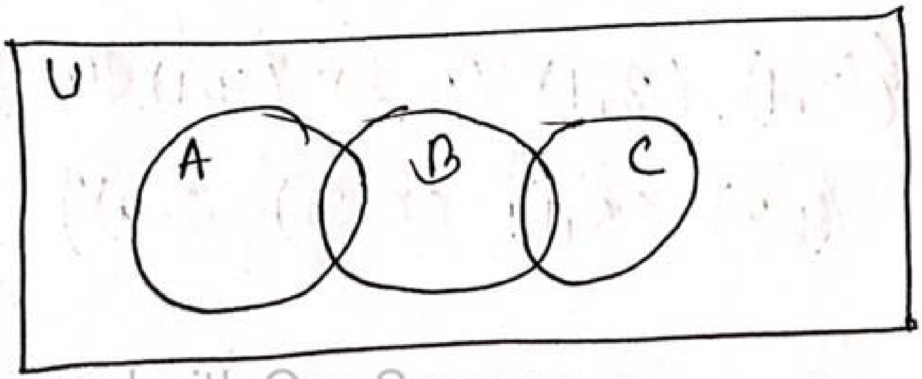
a) U= Universal set



(B)



(C)



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3. Given two relations S and T from A to B,

$S \cap T = \{(x,y) \in A \times B \mid (x,y) \in S \text{ and } (x,y) \in T\}$.

$S \cup T = \{(x,y) \in A \times B \mid (x,y) \in S \text{ or } (x,y) \in T\}$.

let $A = \{-1, 1, 2, 4\}$ and $B = \{1, 2\}$ and defined binory relations S and T from A to B as follows:

for all $(x,y) \in A \times B$, $x S y \leftrightarrow |x| = |y|$

For all $(x,y) \in A \times B$, $x T y \leftrightarrow x - y$ is even

State explicitly which ordered pairs are in $A \times B$, S, T, $S \cap T$ and $S \cup T$.

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

(b) $S = S y \leftrightarrow |x| = |y|$, $A \times B$

$|-1| = |1|$, $|1| = |1|$, $|2| = |2|$

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

(c) $T = T y \leftrightarrow x - y$ is even, $A \times B$

$-1-1 = -2$, $1-1=0$, $2-2=0$, $4-2=2$

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

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

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

④ $\neg((\neg p \wedge q) \vee (\neg p \wedge \neg q) \vee (p \wedge q) \equiv \cancel{q}\, p$.

$\Rightarrow \neg(\neg p \wedge q) \cancel{\vee} \wedge \neg(\neg p \wedge \neg q) \vee (p \wedge q)$ [$\because$ De morgan's law]

$\Rightarrow (p \vee \neg q) \wedge (p \vee q) \vee (p \wedge q)$ [$\because$ De morgan's law].

$\Rightarrow (p \vee (\neg q \wedge q)) \vee (p \wedge q)$ [$\because$ Distributive law].

$\Rightarrow (p \vee F) \vee (p \wedge q)$ [Negatiation law].

$\Rightarrow p \vee (p \wedge q)$. [Absorption law].

$\Rightarrow p$

5.

a) $R_1 = \{(1,1), (1,2), (1,3), (1,4), (1,5), (2,1), (2,2), (2,3), (2,4), (3,1), (3,2), (3,3), (4,1), (4,2), (5,1)\}$

$$A1 = \begin{array}{c|ccccc} & 1 & 2 & 3 & 4 & 5 \\ \hline 1 & 1 & 1 & 1 & 1 & 1 \\ 2 & 1 & 1 & 1 & 1 & 0 \\ 3 & 1 & 1 & 1 & 0 & 0 \\ 4 & 1 & 1 & 0 & 0 & 0 \\ 5 & 1 & 0 & 0 & 0 & 0 \end{array}$$

(b)

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

$$A_2 = \begin{array}{c} \\ 1 \\ 2 \\ 3 \\ 4 \\ 5 \end{array} \begin{array}{c} \begin{array}{ccccc} 1 & 2 & 3 & 4 & 5 \end{array} \\ \left[\begin{array}{ccccc} 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 & 0 \\ 1 & 1 & 1 & 0 & 0 \\ 1 & 1 & 1 & 1 & 0 \end{array}\right] \end{array}$$

(c)

not reflexive, symmetric, not transitive

here,
equivalence relation must be symmetric, reflexive and transitive.

So, R_1 is not an equivalence relation.

(d)

not symmetric, not transitive and
not reflexive.

here,

Partial order must be
antisymmetric, reflexive
and transitive

So, R2 is not a partial
order relation.

(A4.

⑥ a) $$R_1 = \begin{array}{cc} & \begin{array}{ccc}1 & 2 & 3\end{array} \\ \begin{array}{c}1\\2\\3\end{array} & \begin{bmatrix}1 & 0 & 0\\0 & 1 & 1\\1 & 0 & 1\end{bmatrix}\end{array}$$

$R_1 = \{(1,1), (2,2), (2,3), (3,1), (3,3)\}$.

$$R_2 = \begin{array}{cc} & \begin{array}{ccc}1 & 2 & 3\end{array} \\ \begin{array}{c}1\\2\\3\end{array} & \begin{bmatrix}0 & 1 & 0\\0 & 1 & 0\\1 & 0 & 1\end{bmatrix}\end{array}$$

$R_2 = \{(1,2), (2,2), (3,1), (3,3)\}$.

$R_1 \cup R_2 = \{(1,1), (1,2), (2,2), (2,3), (3,1), (3,3)\}$.

$$R_1 \cup R_2 = \begin{array}{cc} & \begin{array}{ccc}1 & 2 & 3\end{array} \\ \begin{array}{c}1\\2\\3\end{array} & \begin{bmatrix}1 & 1 & 0\\0 & 1 & 1\\1 & 0 & 1\end{bmatrix}\end{array}$$

ⓑ $R_1 \cap R_2 = \{(2,2), (3,1), (3,3)\}$.

$$R_1 \cap R_2 = \begin{array}{cc} & \begin{array}{ccc}1 & 2 & 3\end{array} \\ \begin{array}{c}1\\2\\3\end{array} & \begin{bmatrix}0 & 0 & 0\\0 & 1 & 0\\1 & 0 & 1\end{bmatrix}\end{array}$$

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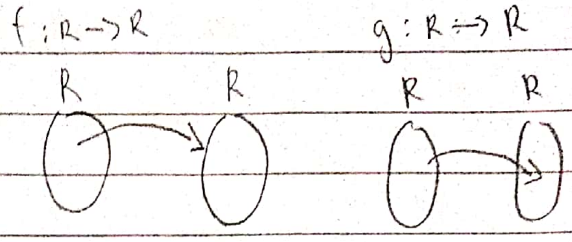
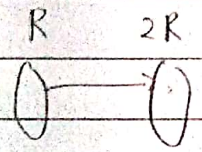
7. If $f: R \to R$ and $g: R \to R$ are both one to one, is $f+g$ also one to one? Justify your answer.

$f(R) = R$

$g(R) = R$



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



$f+g$ is not one to one.

8. With each step you take when climbing a staircase, you can move up either one stair or two stairs. As a result, you can climb the entire staircase taking one stair at a time, taking two at a time, or taking a combination of one - or two stair increments. For each integer $n \geq 1$, if the staircase consists of n stairs, let c_n be the number of different ways to climb the staircase. Find a reccurence relation for $c_1, c_2, \ldots c_n$.

C_n = number of different ways to climb the staircase.

C = climb the entire staircase

$(n+1)$ = the ways

$c_n = c(n+1) + c_n$

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

$t_3 = t_{3-1} + t_{3-2} + t_{3-3}$.

$\Rightarrow t_3 = t_2 + t_1 + t_0$.

$\Rightarrow t_3 = 1 + 1 + 0$.

$\therefore t_3 = 2$

$t_4 = t_{4-1} + t_{4-2} + t_{4-3}$

$\Rightarrow t_4 = t_3 + t_2 + t_1$

$\Rightarrow t_4 = 2 + 1 + 1$

$\therefore t_4 = 4$.

$t_5 = t_{5-1} + t_{5-2} + t_{5-3}$

$\Rightarrow t_5 = t_4 + t_3 + t_2$

$\Rightarrow t_5 = 4 + 2 + 1$.

$\therefore t_5 = 7$.

$t_6 = t_{6-1} + t_{6-2} + t_{6-3}$

$\Rightarrow t_6 = t_5 + t_4 + t_3$.

$\Rightarrow t_6 = 7 + 4 + 2$.

$\therefore t_6 = 13$.

$t_7 = t_{7-1} + t_{7-2} + t_{7-3}$.

$\Rightarrow t_7 = t_6 + t_5 + t_4$.

$\Rightarrow t_7 = 13 + 7 + 4$.

$\therefore t_7 = 24$.

(b) • input (n)

• output ~~f~~ t(n)

```
t(n) {
    if (n==1) or (n==2).
        return 1 .
    else if (n==0)
        return 0 .
    else:
     return tribonacci(n-1)+ tribonacci(n-2)+ tribonacci(n-3)
}.
```