SCHOOL OF COMPUTING

SESSION 2020/2021 SEMESTER 1

SECI 1013 -07

DISCRETE STRUCTURE

ASSIGNMENT 1

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NO: DATE:

QUESTION 1

~~a) AUC~~ $A = \{1,2\}$

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

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

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

b) $(A \cup B)' =$

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

$(A \cup B)' = \{x \in R \mid x \neq \{1,2,3\}\}$

c) $A' \cup B' = \{x \in R \mid x \neq \{1,2\}\}$

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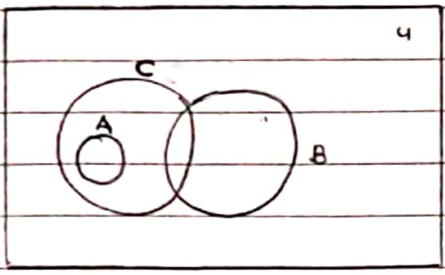
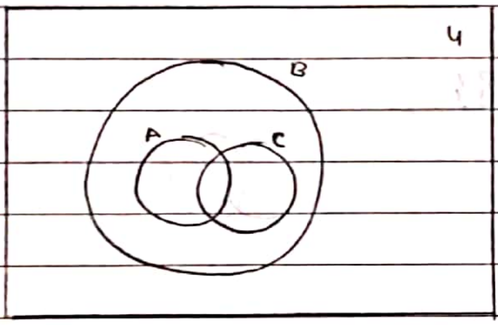
QUESTION 2

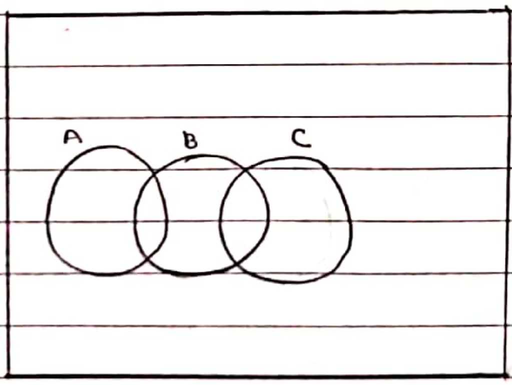
a) $A \cap B = \emptyset , A \subseteq C , C \cap B \neq \emptyset$



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



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



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Ans: To the question No:3.

Given,

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

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

$$A = \{-1, 1, 2, 4\}$$

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

So,

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

and $(x,y) \in A \times B$, $xTy \leftrightarrow x-y$.

Now,

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

$\Rightarrow$ $xSy \leftrightarrow |x| = |y|$

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

$\Rightarrow$ $xTy \leftrightarrow x-y$

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

~~Q.No 7~~ =

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

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

Ans: To the question No: 4

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

$\neg(\neg p\wedge(p\vee\neg q))\vee(p\wedge q)\equiv p$ [ditribute law]

$\neg(\neg p\wedge 1)\vee(p\wedge q)\equiv p$ [Complement law]

$\neg\neg p\vee(p\wedge q)\equiv p$ [properties of 1's]

$p\vee(p\wedge q)\equiv p$ [Double Negection Law]

$p\equiv p$ [Abrorption Law]

QUESTION 5

$R_1 = \{(x,y) \mid x+y \leq 6\}$

$R_2 = \{(y,z) \mid y > z\}$

a)

$$A_1 = \begin{array}{c|c} & \begin{array}{ccccc} 1 & 2 & 3 & 4 & 5 \end{array} \\ \begin{array}{c} 1 \\ 2 \\ 3 \\ 4 \\ 5 \end{array} & \begin{bmatrix} 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 0 \\ 1 & 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 \end{bmatrix} \end{array}$$

b)

$$A_2 = \begin{array}{c|c} & \begin{array}{ccccc} 1 & 2 & 3 & 4 & 5 \end{array} \\ \begin{array}{c} 1 \\ 2 \\ 3 \\ 4 \\ 5 \end{array} & \begin{bmatrix} 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 & 0 \\ 1 & 1 & 1 & 0 & 0 \\ 1 & 1 & 1 & 1 & 0 \end{bmatrix} \end{array}$$

c) Is R_1 ~~fe~~ reflexive, symetric, transitive and/or an equivalance relation?

: R_1 is not reflexive, symetric, not transitive and not equivalance relation

d) Is R_2 reflexive, antisymetric, transitive, and/or partial order relation?

: R_2 ~~irreflexive~~ not reflexive (irreflexive), not antisymetric, not transitive and not partial order relation

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QUESTION 6

R_1 on $\{1,2,3\}$

$$M_{R_1} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 1 & 0 & 1 \end{bmatrix}$$

R_2 on $\{1,2,3\}$

$$M_{R_2} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}$$

a) the matrix of relation $R_1 \cup R_2$

$$M_{R_1 \cup R_2} = \begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 0 & 1 \end{bmatrix}$$

b) the matrix of relation $R_1 \cap R_2$

$$M_{R_1 \cap R_2} = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}$$

Solution - 07

given that $f: R \to R$ is one-one function.

then $f(x_1) = f(x_2)$. where $x_1 = x_2$ — (i)

and $g: R \to R$ is one-one function

then $g(x_1) = g(x_2)$ where $x_1 = x_2$ — (ii)

To show:- $(f+g)$ is one-one

let $x_1 = x_2$ then we show that

$$(f+g)(x_1) = (f+g)(x_2)$$

$$(f+g)(x_1) \Leftrightarrow f(x_1) + g(x_1)$$

$$\Rightarrow f(x_2) + g(x_2) \quad (\text{use eq (i) and (ii)})$$

$$\Rightarrow (f+g)x_2$$

Hence if f and g both are one-one then $f+g$ also one-one function.

(Justified)

Answer 8

When there is only one stair case $c(1)$, only one step can be taken. So, $c(1) = 1$.

When there is two staircase, $c(2)$, either one and one step or just one time two step can be taken.

So, $c(2) = 2$.

For any stair n, we can say to reach stair n, one can take one step from stair $n-1$ or take two step from stair $n-2$. So, we can say number of ways to reaching stair n as $c(n) = c(n-1) + c(n-2)$ where $n >= 3$.

Hence, recurrence relation for number of ways to climb stair it will be

$c(i) = c(i-1) + c(i-2)$ where $i >= 3$ and $i <= n$

$c(1) = 1$

$c(2) = 2$.

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QUESTION 9

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

a) find t_7

$t_0 = 0$
$t_1 = 1$
$t_2 = 1$
$t_3 = 1 + 1 + 0 = 2$
$t_4 = 2 + 1 + 1 = 4$
$t_5 = 4 + 2 + 1 = 7$
$t_6 = 7 + 4 + 2 = 13$
$t_7 = 13 + 7 + 4 = 24$

$t_7 = 24$

b) write a recursive algorith to compute t_n, $n \geq 0$

Input : n
Output : f(n)

```
f(n){
  if (n=0)
     return 1
  if (n=1 or n=2)
     return 1
  return f(n-1) + f(n-2) + f(n-3)
}
```