Subject:.. Date: . .

Assignment 1
Group 16

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Subject: Assignment

No:

Date:

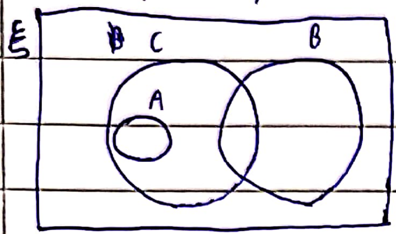
1\. a) $A \cup C = \{1, 2, 3, 4, 5, 6, 7, 8\}$

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

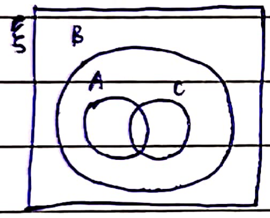
$= \{4, 5, 6, 7, 8\}$

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

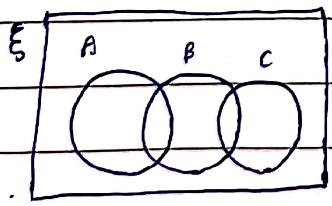
2\. a) $A \cap B = \emptyset$, $A \subseteq C$, $C \cap B \neq \emptyset$



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



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



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

$x S y \leftrightarrow |x| = |y|$

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

$x T y \leftrightarrow x - y$ is even

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

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

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

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

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

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

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

$= p \vee (\neg q \wedge q) \vee (p \wedge q)$ — Distributive laws

$= p \vee (p \wedge q)$ — Identity laws

$= p$ — Absorption laws

5.a)

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

b)

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

c)

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

= Not reflexive, symmetric, not transitive, not equivalence relation

d)

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

= Irreflexive, asymmetric, not transitive, not ~~equivalence~~ partial order relation

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

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

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

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

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

7. $(f+g)(x) = f(x) + g(x)$
$f(x_1) = f(x_2)$
$g(x_1) = g(x_2)$
$f(x_1) + g(x_1) = f(x_2) + g(x_2)$
$= (f+g)(x_2)$
$f+g$ is also one-to-one

8. $n =$ number of stairs
$C_n =$ number of ways

number of ways to climb if final step is single stair : ~~C_n-1~~ C_{n-1}
number of ways to climb if final step is two stairs : ~~C_n-2~~ C_{n-2}
Recurrence relation:
~~$C_n = C_{n-1}$~~
$C_n = C_{n-1} + C_{n-2}$, $n \geq 3$

Subject...

9. $t_1 = t_2 = t_3 = 1$, $t_n = t_{n-1} + t_{n-2} + t_{n-3}$ for all $n \geq 4$

a) $t_7 = t_6 + t_5 + t_4$

$t_4 = t_3 + t_2 + t_1$

$= 1+1+1$

$= 3$

$t_5 = t_4 + t_3 + t_2$

$= 3+1+1$

$= 5$

$t_6 = t_5 + t_4 + t_3$

$= 5+3+1$

$= 9$

$t_7 = 9+5+3$

$= 17$

b) Input: n

Output: f(n)

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