DISCRETE STRUCTURE (SECI 1013-03)

SEMESTER 1-2020/2021

ASSIGNMENT#3

GROUP 13

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Question 1

a) i) $A - B = \{ 1,3,4,6,7,8\}$
ii) $A \cap B = \{2,5\}$
$(A \cap B) \cup C = \{2,5, a, b\}$
iii)$A \cap B \cap C = \{ \}$
iv) $B \times C = \{(2, a), (2, b), (5, a), (5, b), (9, a), (9, b)\}$
v) $P(C) = \{\emptyset, \{a\}, \{b\}, \{a, b\}\}$

b) $(P \cap ((P' \cup Q)')) \cup (P \cap Q) = (P \cap ((P')' \cap Q')) \cup (P \cap Q)$ *De Morgan's law*
$= (P \cap (P \cap Q')) \cup (P \cap Q)$ *Complement law*
$= ((P \cap P) \cap Q') \cup (P \cap Q)$ *Associative law*
$= (P \cap Q') \cup (P \cap Q)$ *Idempotent law*
$= P \cap (Q' \cup Q)$ *Distributive law*
$= P \cap (U)$ *Complement law*
$= P$ *properties of universal set*

c)

p	q	$\neg p$	$\neg p \vee q$	$q \rightarrow p$	$(\neg p \vee q) \leftrightarrow (q \rightarrow p)$
T	T	F	T	T	T
T	F	F	F	T	F
F	T	T	T	F	F
F	F	T	T	T	T

d) Let $x = 2y + 1$
$(x + 2)^2 = x^2 + 4x + 4$
$= (2y + 1)^2 + 4(2y + 1) + 4$
$= 4y^2 + 4y + 1 + 8y + 4 + 4$
$= 2(2y^2 + 6y + 4) + 1$
$let\ k = 2y^2 + 6y + 4$
$= 2k + 1\ (odd)$

e) i) True
(2,1)- true
(-1,0)-false
ii) true
(3,2)- true
(3,4)-false

Question 2

A(i)

Domain = {1,2,3}

Range = {1,2}

A(ii)

R= {(1,1), (1,2), (2,2), (3,1)}

R is not irreflexive because the diagonal of matrix R is not 0 which (3,3)! ∈ R for every x ∈ R.

But R is antisymmetric because the relation of R is one way which has (1,2) but no (2,1) and has (3,1) but no (1,3).

B(i)

S = {(4,5), (5,4), (5,5)

B(ii)

S is not reflexive because the diagonal of matrix S is not 1.

S is symmetric because (4,5) ∈ S and (5,4) ∈ S.

$$\begin{bmatrix} 0 & 1 \\ 1 & 1 \end{bmatrix} \text{x} \begin{bmatrix} 0 & 1 \\ 1 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$$

The product of Boolean show that S is not transitive.

S is not equivalence relation because s is not reflexive and not transitive.

c)

i) f: X→Y = {(1,1), (2,2), (3,3)}
ii)g: X→Z = {(1,1), (2,1), (3,1)}
iii)h: X→X = {(1,1), (2,2), (3,1)}

d)
i)
m(x) = y
4x + 3 = y
4x = y -3
x = $\frac{y-3}{4}$
$m^{-1}(x) = \frac{x-3}{4}$

ii)
n(m(x))
= n(4x+3)
= 2(4x+3) -4
= 8x+6-4
= 8x + 2

Question 3

a) i. $a_k=a_{k-1}+2k$, $k\geq2$

$a_1=1$

$a_2= a_1+2(2)$

$=1+4$

$=5$

$a_3= a_2+2(3)$

$=5+6$

$=11$

ii. input=k

output= a(k)

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a(k){
    if(k=1)
      return 1
  return a(k-1)+2*k
}
```

b) $r_k= 2r_{k-1}$, when $k\geq2$

$r_1=7$

$r_2= 2 \text{ x } 7 = 14$

$r_3= 2 \text{ x } 14 = 28$

$r_4= 2 \text{ x } 28 = 56$

the sequence produce is,

7,14,28,56,…

c) S(4)

n=4

because n≠1

return 5*S(4-1)

S(4)=625

Return 5 X 125

S(3)

n=3

because n≠1

return 5*S(3-1)

S(3)=125

Return 5 X 25

S(2)

n=2

because n≠1

return 5*S(2-1)

S(2)=25

Return 5 X 5

S (1)

n=1

because n=1

return 5

S(1)=5

Return 5

∴S(4)=625

Question 4

a) First digit: 9 ways (3,4,5,6,7,8,9,A,B)
Second digit:16 ways
Third digit: 16 ways
Fourth digit: 11 ways (5,6,7,8,A,B,C,D,E,F)

Total ways= 9X16X16X11=25344

b) First letter= 1 way (A)
Second letter = 26 ways
Third letter = 26 ways
Fourth letter = 26 ways

First digit = 10 way (0,1,2,3,4,5,6,7,8,9)
Second digit = 10 way
Third digit = 1 way (0)

Total ways= 1X26X26X26X10X10X1 = 26^3X10^2= 1757600

c) 1 letter
First= 8 ways

Total = 8 ways

2 letter
First= 8 ways
Second= 7 ways

Total = 8X7=56 ways

3 letter
First= 8 ways
Second= 7 ways
Third = 6 way

Total = 8X7X6=336 ways

∴Total ways=8+56+336=400 ways

d) Select 3 men

C(6,3)=$\frac{6!}{3!(6-3)!}$

=$\frac{6!}{3!3!}$

= 20 ways

Select 4 women

C(7,4)=$\frac{7!}{4!(7-4)!}$

=$\frac{7!}{4!3!}$

= 35 ways

∴total ways= 20X35

= 700 ways

e) $\frac{11!}{1!1!1!2!1!2!1!1!1} = \frac{39916800}{4} = 9979200\ way$

f) $C(10+6-1,10)$

$$C(15,10) = \frac{15!}{10!(15-10)!}$$

$$= \frac{15!}{10!\,5!}$$

= 3003 ways

Question 5

a)

3 first names and 2 last names: 3 x 2 =6 (k = 6)

N = 18, k=6, m=?

$N = k(m-1) +1$

$18 = 6(m-1) +1$

m = 3.83 (showed at least 3 persons have same first and last names because m > 3)

b)

1-20: 10 odd numbers

Since there are 10 odd numbers from 1 to 10 so we must pick 10+1 which is 11 integers to make sure that we got at least one odd number.

Answer: 11

c)

100/5=20 (20 numbers divisible by 5)

Since there are 80 numbers are not divisible by 5 from 1-100 so we must pick 80+1 numbers which is 81 to make sure that we got at least one number is divisible by 5.

Answer: 81