SCHOOL OF COMPUTING

SEMESTER 1, 2020/2021

SECI1013-07 STRUKTUR DISKRIT

(DISCRETE STRUCTURE)

SECTION: 07

ASSIGNMENT 03

GROUP: 02

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Assignment 03

$\boxed{1}$ ⓐ Here, $A = \{1,2,3,4,5,6,7,8\}$
$B = \{2,5,9\}$
$C = \{a,b\}$

(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) $P(C) = \{\{\},\{a\},\{b\},\{a,b\}\}$

ⓑ $(P \cap ((P' \cup Q)')) \cup (P \cap Q)$

$\Rightarrow (P \cap (P \cap Q')) \cup (P \cap Q)$

$\Rightarrow (P \cap P) \cap Q' \cup (P \cap Q)$

$\Rightarrow P \cap Q' \cup (P \cap Q)$

$\Rightarrow P \cap ((Q' \cup P) \cap (Q' \cup Q))$

$\Rightarrow P \cap (Q' \cup P \cap T)$

$\Rightarrow P \cap P \quad \Rightarrow P$

(c) $A = (\neg p \vee q) \longleftrightarrow (q \rightarrow p)$

p	q	$\neg p$	$\neg p \vee q$	$q \rightarrow p$	A
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, For all integer 'X'
if 'x' is odd
Then $(X+2)^2$ is odd

Now, $A(X)$: x is odd
$B(X)$: $(X+2)^2$ is odd

$\forall k \in \mathbb{Z} \ni x = (x+2)^2$

Point a, $x=1$, $(x+2)^2 = (1+2)^2$
$= 9$ (odd)

Point b, $x=3$, $(x+2)^2 = (3+2)^2$
$= 25$ (odd)

Point c, $x=5$, $(x+2)^2 = (5+2)^2$
$= 49$ (odd)

When $x = 2n+1, \forall n \in \mathbb{Z} \ni 2n+1$

$(x+2)^2 = (2n+1+2)^2$

$= 4n^2 + 8n + 4 + 1$

$= 2(2n^2 + 4n + 2) + 1$

$= 2m + 1 \quad (\because m = 2n^2 + 4n + 2)$

So, $(x+2)^2$ is odd when x is odd

The statement "For all integer x, if x is odd, then $(x+2)^2$ is odd" — Proved

(e) (i) When, x is 5, y is 3.

$P(x,y) : x \geq y$
$: 5 \geq 3$

Condition is fixed when x is 5, y is 3

$\exists x \exists y \, P(x,y)$ is True.

(ii) When x is 3, y is 5

$P(x,y) : x \geq y$
$: 3 \geq y$

Not fixed the condition when x is 3, y is 5

$\forall x \forall y \, P(x,y)$ is False.

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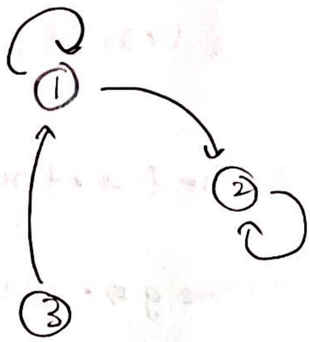
Q2

a) ~~R~~ matrix R :

$$\begin{array}{c|ccc} & 1 & 2 & 3 \\ \hline 1 & & & \\ 2 & & \left[\begin{matrix} 1 & 1 & 0 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \end{matrix}\right] & \\ 3 & & & \end{array}$$



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

i) doman R : { 1, 2, 3 }

range R : { 1, 2 }

ii) ~~R is~~ Relatian R is an antisymmetric because (3,1) ∈ R but (1,3) ∉ R. Hence it is not ~~reflective~~ ~~transitive~~ symmetric. And it has reflective relations where (1,1) ~~and~~, (2,2) ∈ R

b) S = { (x, y) | x+y ≥ 9 } , X = { 2, 3, 4, 5 }

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

ii) Relatian S is a reflexive and symmetric relation. It has (5,5) ∈ R which an reflexive relatian and (4,5) ∈ R , (5,4) ∈ R which shows it is symmetric.

Q2

c) $X = \{1, 2, 3\}$, $Y = \{1, 2, 3, 4\}$, $Z = \{1, 2\}$

i) Define $f \Rightarrow$ • $f(x) = x$, $f = \{(1,1), (2,3), (3,4)\}$

ii) Define $g \Rightarrow$ • $g(1) = 1$, $g(2) = 1$, $g(3) = 2$

• $g = \{(1,1), (2,1), (3,2)\}$

iii) Define $h \Rightarrow$ • $h(x) = 1$

• $h = \{(1,1), (2,1), (3,1)\}$

d) i) Find inverse of m

$m(x) = 4x + 3$

let $m(x) = y$

& $y = 4x + 3$

$x = \dfrac{y-3}{4}$

$\therefore m^{-1}(x) = \dfrac{x-3}{4}$

ii) $n \circ m$

$= n(m(x))$

$= 2(4x+3) - 4$

$= (8x + 6) - 4$

$= 8x + 2$

Q 3

a) $a_k = a_{k-1} + 2k$, $\forall k \geq 2$, $a_1 = 1$

i) $a_1 = 1$

$a_2 = a_1 + 2(2)$

$= 1 + 4$

$= 5$

$a_3 = a_2 + 2(3)$

$= 11$

$a_4 = a_3 + 2(4)$

$= 11 + 8$

$= 19$

ii) input: k

output: a(k)

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

Q3

b) input = 1 ⇝ ouput = 7

$r_1 = 7$

$r_2 = 2 \times 7 = 14$

$r_3 = \cancel{2x}\ 2 \times (2 \times 7)$

$r_4 = 2 \times (2 \times 2 \times 7)$

$\therefore r_k = (2^{k-1}) \times 7$

c)

S(4)

n = 4 , n ≠ 1

return 5 * S(4-1)

↓

S(3)

n = 3 , n ≠ 1

return 5* S((3)-1)

↓

S(2)

n = 2 , n ≠ 1

return 5* S((2)-1)

↓

S(1)

n = 1 .

return 5

∴ S(4) = 625

• Return 5(125)

S(3) = 125

• Return 5 (25)

S(2) = 25

• Return (5) 5

• return 5

S(4) = 625 ✱

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Question 4

ⓐ

There are sixteen hexadecimal digits

0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F

The hexadecimal numbers need to start with a digit from 3 to B need to end with a digit from 5 to F while the number contains 4 digits.

1st Digit: 9 ways ~~: 4 ways~~ (3, 4, 5, 6, 7, 8, 9, A, B)

2nd Digit: 16 ways

3rd Digit: 16 ways

4th Digit: 11 ways (5, 6, 7, 8, 9, A, B, C, D, E, F)

So, $9 \times 16 \times 16 \times 11 = 25344$ ways.

ⓑ

$\underline{1}$ $\underline{26}$ $\underline{26}$ $\underline{26}$ $\underline{10}$ $\underline{10}$ $\underline{1}$

$1 \times 26 \times 26 \times 26 \times 10 \times 10 \times 1 = 1757600$ ways.

ⓒ

$8 + {}^8P_2 + {}^8P_3$

1 2 3 4 5 6 7 8
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$= 8 + 56 + 336 = 400$ arrangements.

(d)

7 women 6 men

$^{7}C_{4} \times {}^{6}C_{3} = 35 \times 20 = 700$

(e)

~~Prob~~. PROBABILITY 11

$\frac{11!}{2!\,2!} = \frac{39916800}{4} = 9979200$ ways

(f)

select $r = 10$ pastries from the $n = 6$ kind of pastry

$C(n+r-1, r)$

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

$= \frac{(6+10-1)!}{10!\,(6-1)!}$

$= \frac{15!}{10!\,5!} = 3003$

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No.

Date

5 (a) The person first & last name are

$3 \times 2 = 6 \Rightarrow$ Pigeonholes

$\Rightarrow$ Probabilities of the name.

$18 \Rightarrow$ Pigeon $\Rightarrow$ Person's

□	□	□	□	□	□
1	2	3	4	5	6
7	8	9	10	11	12
13	14	15	16	17	18

Here, by pigeonhole principle some of pigeon holes have at least 3 pigeons.

(b) Even Number $= \{2,4,6,8,10,12,14,16,18,20\}$

$= 10$ Numbers

Odd number $= \{1,3,5,7,9,11,13,15,17,19\}$

$= 10$ Numbers

Here, $(10+1) = 11$ integer numbers.

ⓒ Here, 5, 10, 15, 20, 25, 30, 35, 40,
45, 50, 55, 60, 65, 70, 75, 80,
85, 90, 95, 100.

∴ 20 are divisible by 5 (Pigeonhole, $k = 80$)
80 are not divisible by 5 (Pigeon $n > 80$ ($n > k$)

∴ Pick 81 integers between 1 to 100.
in order to be sure of getting on
that divisible by 5.