Faculty
Of
Computing

SEMESTER I 2024/2025

SECI1013
Discrete Structure I

Assignment 2

NAME	Matric No.	Signature
1.AMAN SUFIAN SHAH BIN SHAMSUDDIN	A24CS0046	
2. KALAITHARAN A/L PALANYVELU	A24CS0091	
3.AHMAD IRFAN BIN AZAHAN	A24CS0036	
Name of Lecturer	**SECTION**	
Dr Noorfa Haszlinna Binti Mustaffa	02	

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Question 1

Question 1

(a)

- 3 car routes
- 4 walking routes

- 4 car routes
- 5 walking routes

P4 (home) $\longrightarrow$ P5 $\longrightarrow$ P6 (school)

(n_1) ways from P4 to P5 : $3+4=7$

(n_2) ways from P5 to P6 : $4+5=9$

$$n_1 \cdot n_2 = 7 \times 9$$
$$= 63 \text{ ways}$$

$\therefore$ Ali can travel from Presint 4 to Presint 6 in 63 ways.

(b) (i) $\underline{S}\ \underline{O}\ \underline{F}\ \underline{T}\ \underline{W}\ \underline{A}\ \underline{R}\ \underline{E}$

$n=8$

total arrangements $= 8!$

$= 40320$ ways

ii) $r = 5$
$n = 8$

$$P(n,r) = \frac{n!}{(n-r)!}$$

$$P(8,5) = \frac{8!}{(8-5)!}$$

_ _ _ _ _

$= 6720$ ways

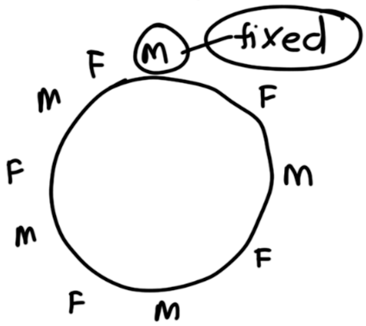
(iii)

$$S \ \underbrace{\_\ \_\ \_\ \_\ \_\ \_}_{n=6} \ E$$

$6! = 6 \times 5 \times 4 \times 3 \times 2 \times 1$

$= 720$ ways

(c) (i)



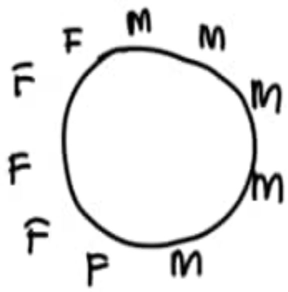
$4! \times 5! = 24 \times 120$

$= 2880$ ways

(ii) $(n-1)! = (9-1)! = 8!$

$8! \times 2 = 40320 \times 2 = 80640$ ways

(iii)



1 boy group, 1 girls group (2 block)

number of arrangement $= (2-1)! \times 5! \times 5!$

$= 1 \times 120 \times 120$

$= 14400$ ways

Question 2

QUESTION 2 **[10 MARKS]**

a) From a group of 8 men and 6 women, five persons are to be selected to form a committee so that at least 3 women are on the committee. In how many ways can it be done?

2)a) 3 women × 2 men = ${}^6C_3 \times {}^8C_2 = 560$
4 women × 1 men = ${}^6C_4 \times {}^8C_1 = 120$
5 women × 0 men = ${}^6C_5 \times {}^8C_0 = 6$

$560 + 120 + 6 = 686$

b) The SE Students in MJIIT need to form a group for Discrete Structure Assignments. The group must contain four students. Given that the total number of students is 20, half of it is girls. How many different ways can a group be selected if at least one boy must be there in the team? (5 marks)

2)b) If no boys are chosen:

$T_1 = {}^{10}C_0 \times {}^{10}C_4 = 210$

Total number of ways to form a group of 4 from 20 students:

$T_2 = {}^{20}C_4 = 4845$

At least one boy must be in the team:

$T_2 - T_1 = 4845 - 210 = 4635$

Question 3

Question 3

a(i) Arrangement circular formula, $n = 5$

$(n-1)! = (5-1)! = 24_{\#}$

a(ii) There a 3 case for captain and vice captain to next each other. (both)

$C\,V_1V_2$
$V_1\,C\,V_2$ — 3 case
$V_1V_2\,C$

Vice captain can switch their position

$C\,V_2V_1$
$V_2\,C\,V_1$ — 3 case
$V_2V_1\,C$

~~total 6c~~

balance remaining 2 people

CVV 3 people	1 people	1 people

Circular arrangement

$(3-1)! = 2! = 2 \times 6\text{case}$

$= 12 \text{ ways}_{\#}$

(b) Total Ways without any conditions

$5! = 120$

ways that head and assistant sit next to each other

$\underline{HA}\,\_\,\_\,\_ = 4! = 24$

$AH\,\_\,\_\,\_ = 4! = 24$

$\underline{48 \text{ ways}}$

ways that assistant and head did not sit to each other

$= 120 - 48 = 72 \text{ ways}_{\#}$

c) i) If there are no restrictions

$n = 6$ (half of dozen)
$k = 10$ (total types)

- order doesn't matter
- repetition is allowed

$$\frac{(n+k-1)}{k-1} = \frac{6+10-1}{10} = \frac{15}{9}$$

$$\frac{15}{9} = {}^{15}C_9 = \frac{15!}{9!(15-9)!} = 5005 \text{ ways}$$

C(ii) If there at least 4 hazelnut flavoured chocolate

- Case 4 hazelnut

ways to arrange 4 hazelnut is 1ways

balance 2 chocolate to buy from 9 types of chocolate

$n = 2$

$k = 9$ $\quad \frac{(9+2-1)}{(9-1)} = \frac{10}{8} = {}^{10}C_8 = \frac{10!}{8!(10-8)!} = 45 \text{ ways}$

$45 \times 1 = 45$ ways (4 Hazelnut)

- Case 5 hazelnut

$n = 1$

$k = 9$ $\quad \frac{(9+1-1)}{9-1} = \frac{9}{8} = {}^{9}C_8 = \frac{9!}{9!(9-8)!} = 9$ ways (5 Hazelnut)

- Case 6 hazelnut

$n = 0$

$k = 9$ $\quad \frac{(9+0-1)}{9-1} = \frac{8}{8} = {}^{8}C_8 = 1$ (6 Hazelnut)

$= 1 + 9 + 45 = 55$ ways ※

c) (ii) If there are no two chocolates of the same type

~~210~~ - no repititions is allowed

$^{10}C_6 = \frac{10!}{6!(10-6)!} = 210$ ways #

d (i) $n = 13$
$r = 11$

- no repetitions
- order dosen't matter

$^{13}C_{11} = \frac{13!}{11!(13-11)!} = 78$ ways

d (ii) $n = 13$
$r = 11$

- order matter
- no repetitions

$^{13}P_{11} = \frac{13!}{(13-11)!} = 3113510400$ ways

d (iii) $n = 11$
$r = 1$ (1 woman)

- order dosen't matter
- no repetitions

1 woman 10 man

$^{10}C_{10} = \frac{10!}{10!(10-10)!} = 1$ ways $\quad ^{3}C_1 = \frac{3!}{1!(3-1)!} = 3$ ways $\quad 1 \times 3 = 3$ ways (1 woman)

2 woman 9 man

$^{10}C_9 = \frac{10!}{9!(10-9)!} = 10$ ways $\quad ^{3}C_2 = \frac{3!}{2!(3-2)!} = 3$ ways $\quad 3 \times 10 = 30$ ways (2 woman)

3 woman 8 man

$^{10}C_8 = \frac{10!}{8!(10-8)!} = 45 \quad ^{3}C_3 = \frac{3!}{3!(3-3)!} = 1 \quad 45 \times 1 = 45$ ways (3 woman)

$45 + 30 + 3 = 78$ ways (at least 1 woman) #

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Questions 4

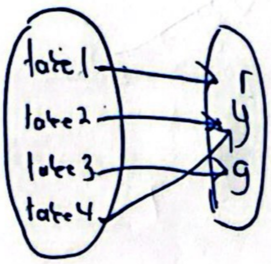
Question 4

4(a) In the box, there is 3 types of colour ball which is yellow, green, red

assume we take 3 ball in the box and get 3 different colour. Then we need to take another ball to get two ball of the same colour

Therefore: pigeonholes = 3 (r/y/g)

pigeon = 4 (amount that we need to take the ball)



In conclusion, 4 balls must be taken to get two balls of the same colour

4(b) 1 cake = 8 pieces

10 cake = 80 pieces (8×10)

total people: 30 + 2 = 32 people

$m = \frac{n}{k}$ $n = 80$, $k = 32$

$m = \frac{80}{32} = 2.5 \approx 3$ pieces for each person (prove)

∴ This show that with 80 pieces of cheese cake and 32 people, each person can get 3 pieces.

4(c) order pair that sum is 10

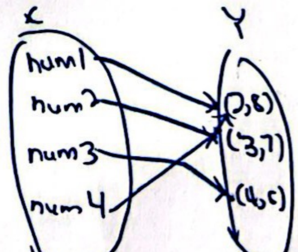
$Y = \{(2,8), (3,7), (4,6)\}$ (3 order paired)

pigeonhole = 3

pigeon = pigeonhole + 1

= 4

$X = \{num1, num2, num3, num4\}$



∴ Therefore, at least 4 number must be choosen so that any set have at least 1 pair of sum is 10.

(d) At least 1 type of grade has 6 student will recieve.

$m = \frac{n}{k}$ $\quad k = 5$ (A, B, C, D, E)

$n = ?$

$m = 5.1$

$\frac{n}{5} = 5.1$

$n = 5.1 \times 5$

$n = 25.5 \rightarrow 26$ student $\quad \therefore$ Therefore minimum number of student is 26 so that at least 6 student will recieve the same grade.

(e) Let $X = \{C_i, C_{i+1} \dots\}$ (X be the set of computer) $1 \leq i \leq 6$

Let $Y = \{n_i, n_{i+1} \dots\}$ (Y be the set of amount computer connected) $0 \leq i \leq 5$

Assume that there is one of computer ~~are~~ is not connecting with any computer

$x_i = 0$

Therefore

$Y = \{n_i, n_{i+1} \dots\}$ $(0 \leq i \leq 4)$

So pigeonhole(k): $|Y| = 5$

pigeon(n): $|X| = 6$

$m = \frac{n}{k} = \frac{6}{5} = 1.2 \rightarrow 2$ (prove)

Therefore, there are at least two computers that are directly connected to the same number of other computer