ASSIGNMENT 2

GROUP 3

SECTION 03 – 2024/2025

SECI1013 (DISCRETE STRUCTURE)

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Chapter 2 (2.3)

1

i. $a_0 = RM50$

- stock price increase by 2%, then decrease by 2%

a_n = stock price at the end of day

$a_n = (a_{n-1} \times (1 + \frac{2}{100})) \times (1 - \frac{2}{100})$

$a_n = (a_{n-1} \times \frac{102}{100}) \times \frac{98}{100}$, $n \geq 1$

ii

$a_1 = (a_0 \times \frac{102}{100}) \times \frac{98}{100}$

$a_1 = (50 \times \frac{102}{100}) \times \frac{98}{100}$

$a_1 = RM\ 49.98$,

$a_2 = (a_1 \times \frac{102}{100}) \times \frac{98}{100}$

$a_2 = (49.98 \times \frac{102}{100}) \times (\frac{98}{100})$

$a_2 = RM49.96$

$a_3 = (a_2 \times \frac{102}{100}) \times \frac{98}{100}$

$a_3 = (49.96 \times \frac{102}{100}) \times \frac{98}{100}$

$a_3 = RM\ 49.94$,

$a_4 = (a_3 \times \frac{102}{100}) \times \frac{98}{100}$

$a_4 = (49.94 \times \frac{102}{100}) \times \frac{98}{100}$

$a_4 = RM\ 49.92$

Chapter 2 (Question 2)

Arithmetic sequence given: $5, 37/7, 39/7, 41/7, \dots$

a) $5, \frac{37}{7}, \frac{39}{7}, \frac{41}{7}, \dots$

$+2/7 \quad +2/7 \quad +2/7$

$a_0 = 5$

$a_1 = a_0 + \frac{2}{7}$

$\therefore a_n = a_{n-1} + \frac{2}{7}, n \geq 1, a_0 = 5$

b) $a_n = a_{n-1} + \frac{2}{7}, n \geq 1, a_0 = 5$

Pseudo Code:

```
f(n)
{   if (n=1)
        retur 5

    return f(n-1) + 2/7

}
```

Chapter 3.1

1a. T_1 = Getting sum of 6 = 5 ways
T_2 = Getting sum of 10 = 3 ways

Total ways $= T_1 + T_2$
$= 5 + 3$
$= 8$ ways

1b. possible outcome that one die shows number 3
= (3,1) , (3,2) , (3, 3) , (3,4) , (3,5),
(3,6) , (1,3) , (2,3) , (4,3) , (5,3),
(6,3)

T_1 = Atleast one die shows number 3 = 11 ways

Total ways = 11 ways

1c. possible outcomes that the first die (red die) shows number 3
= (3,1) , (3,2) , (3,3) , (3,4) , (3,5), (3,6)

T_1 = Red die must show number 3 = 6 ways

Total ways = 6ways

2a. T_1 = Route from R_1 to R_2 = 2ways

T_2 = Route from R_2 to R_3 = 3ways

Total ways from R_1 to R_3 via R_2 $= T_1 \times T_2$

$= 2 \times 3$

$= 6$ ways

2b. T_1 = Route from R_1 to R_2 = 2 ways

T_2 = Route from R_2 to R_3 = 3 ways

T_3 = Route from R_3 to R_2 = 3 ways

T_4 = Route from R_2 to R_1 = 2 ways

Total ways of round trips from R_1 to R_3 and back to R_1 $= T_1 \times T_2 \times T_3 \times T_4$

$= 2 \times 3 \times 3 \times 2$

= ~~12 ways~~ 36 ways

3. i. T_1 : number of ways main menu = 4 ways

T_2 : number of ways side = 6 ways

T_3 : number of ways of beverage = 5 ways

Number of ways set that contain burger = $4 \times (6 + 5)$

$= 44$ ways

ii. T_1 : Number of ways main menu = 4 ways

T_2 : Number of ways of side = 6 ways

T_3 : Number of ways Nina doesn't like peach or lemon tea = 3

Number of ways if Nina doesn't like peach tea or lemon tea = $4 \times (6+3)$

$= 36$ ways

iii. T_1 : Number of ways main menu = 4 ways

T_2 : Number of ways of side = 6 ways

Number of ways choose main and side only = 4×6

$= 24$ ways

Chapter 3 (3.1) Question 4

T_1 = number of ways to choose chocolate cake = 7 ways

T_2 = number of ways to choose cheesecake = 2 ways

T_3 = number of ways to choose fruity cake = 6 ways

T_4 = number of ways to choose two-layer cake = 1 way

Total ways to choose a cake $= 7+2+6+1$

$= 16$ ways.

Chapter 3 (3.2 & 3.3) . Permutation & Combination

1\. a. Total letters = 26

Total digits = 10

✓ repetition

code → 3 ~~digits~~ letters

→ 5 digits

$= \underline{26} \times \underline{26} \times \underline{26} \times \underline{10} \times \underline{10} \times \underline{10} \times \underline{10} \times \underline{10}$

$= 26^3 \times 10^5$

$= 1\ 757\ 600\ 000$

1\. b First two letter is CS = 1 way

Digits ending with 2 or 3 = 2 ways

$= \underline{1} \times \underline{26} \times \underline{10} \times \underline{10} \times \underline{10} \times \underline{10} \times \underline{2}$

$= 520\ 000$

1\. c. X repetition

$= \underline{26} \times \underline{25} \times \underline{24} \times \underline{10} \times \underline{9} \times \underline{8} \times \underline{7} \times \underline{6}$

$= 26 \times 25 \times 24 \times 10 \times 9 \times 8 \times 7 \times 6$

$= 4\ 71\ 744\ 000$

2a. $n = 10$, $r = 3$

$= C(10,3)$

$= \frac{10!}{3!(10-3)!}$

$= 120$

2b. $n = 15$, $r = 9$

$= C(15,9)$

$= \frac{15!}{9!(15-9)!}$

$= 5005$

2c. word given : DISCRETE

repeating letter : E(x2)

Scenario 1 : no letter "E'

$= C(6,5) \times 5!$

$= \frac{6!}{5!(6-5)!} \times 5!$

$= 720$

scenario 2 : one letter 'E'

$= C(6,4) \times 5!$

$= \frac{6!}{4!(6-4)!} \times 5!$

$= 1800$

scenario 3 : two letter 'E'

$= C(6,3) \times \frac{5!}{2!}$

$= \frac{6!}{3!(6-3)!} \times \frac{5!}{2!}$

$= \cancel{2400}\ 1200$

Total ways $= \overset{1200}{\cancel{2400}} + 1800 + 720$

Total ways $= 3720$ ways

2d. Girls

$n = 10$, $r = 2$

$= C(10,2)$

$= \frac{10!}{2!(10-8)!}$

$= 45$

Boys

$n = 7$, $r = 2$

$= C(7,2)$

$= \frac{7!}{2!(7-2)!}$

$= 21$

Total ways $= 45 \times 21$

Total ways $= 945$ ways

Chapter 3.2 and 3.3

3.

for premutation questions

$n = 20 \quad , r = 3$

$= C(20,3)$

$= \dfrac{20!}{3!\,(20-3)!}$

$= 1140$

for combination questions

$n = 15 \quad , r = 2$

$C(15,2)$

$= \dfrac{15!}{2!\,(15-2)!}$

$= 105$

total ways $= 1140 \times 105$

$= 119700$ ways

Chapter 3(3.4): Pigeonhole Principle

1. $n = 40$ people , $k = 12$ month

$$m = \left\lceil \frac{n}{k} \right\rceil$$

$$m = \left\lceil \frac{40}{12} \right\rceil$$

$$= \lceil 3.3333 \rceil$$

$$m = 4$$

$\therefore$ at least 4 people with same month

2. $n = 35$ students

$k = 11$ different scores ; ~~so~~ score $= \{90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100\}$

$$m = \left\lceil \frac{n}{k} \right\rceil$$

$$m = \left\lceil \frac{35}{11} \right\rceil$$

$$m = \lceil 3.18 \rceil$$

$$m = 4$$

there are atleast 4 students with the some scores.

Chapter 3.4 (Question 3)

Given $X = \{1,2,3,4,5,6,7,8,9,10\}$

Let A be any 6 numbers , $A = \{a_1, a_2, a_3, a_4, a_5, a_6\}$

Let B be sum of 11 , $B = \{(1,10), (2,9), (8,3), (7,4), (5,6)\}$

Cardinality of A, $|A| = 6$

Cardinality of B, $|B| = 5$

By 2nd form pigeonhole principle, at least two distinct element of A must be mapped onto the same element of B.

Hence, if we choose any 6 elements of X, then there is at least one pair that will give the sum of 11.

Chapter 3.4 (Question 4)

$n = 115$ classes

$k = 53$ periods

$$m = \left\lceil \frac{n}{k} \right\rceil$$

$$m = \left\lceil \frac{115}{35} \right\rceil$$

$$= \lceil 2.17 \rceil$$

$$= 3$$

Hence, each period requires atleast 3 classrooms.

Chapter 3.4 (Question 5)

- There are 25 computers
- 1 computer can connect to a maximum of 24 computers
- Each computer needs to be connected to at least 1 computer
- Pigeonhole = connection amount (24)
- Pigeon = computers (25)
- Number of pigeon is more than pigeonhole, so at least 2 computers will have same amount of connection.