**ASSIGNMENT 2 DISCRETE STRUCTURE**
**CHAPTER 2.3 (MICHELLE)**

## Chapter 2 (2.3 Recurrence Relation)

### Question 1

i) * assume RM 50 is day 0 (before day 1 starts)

$50 \times 1.02 \times 0.98 = 49.98$

$a_n = a_{n-1}(1.02 \times 0.98)$

$a_n = a_{n-1}(0.9996)$, $a_0 = 50$, $n \geq 1$

ii) day 4. $n = 4$

$a_1 = a_0(0.9996) = 50(0.9996) = 49.98$

$a_2 = a_1(0.9996) = 49.98(0.9996) \approx 49.96$

$a_3 = a_2(0.9996) = 49.96(0.9996) \approx 49.94$

$a_4 = a_3(0.9996) = 49.94(0.9996) \approx 49.92$

$\therefore$ Stock price at the end of the day 4, $a_4$ is RM49.92.

### Question 2

a) $\overset{n_1}{5}, \overset{n_2}{\frac{37}{7}}, \overset{n_3}{\frac{39}{7}}, \overset{n_4}{\frac{41}{7}}$

$+\frac{2}{7}$ $+\frac{2}{7}$

$a_1 = 5$ | $d = \frac{37}{7} - 5$

$a_2 = \frac{37}{7}$ | $= \frac{2}{7}$

$\therefore a_n = a_{n-1} + \frac{2}{7}$, $a_1 = 5$, $n \geq 2$

b) ~~Input~~

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input = n
output = a_n
a_n {
  if (n = 1)
    return 5
  else
    return a_{n-1} + 2/7
}
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CHAPTER 3.1 (JAY)

Assignment 2 - Chapter 3.2 and 3.3

1. (i) Choosing 3 letters $= P(26,3)$

Choosing 5 digits $= P(10,5)$

Subject codes possible $= P(26,3) \cdot P(10,5)$

$= (26^3)(10^5)$

$= 1\ 757\ 600\ 000$ codes

(ii) Begin with CS $= P(1,1) \cdot P(1,1)$

Choose 1 letter $= P(26,1)$

Choose 4 digits $= P(10,4)$

Choose 3 or 2 $= P(2,1)$

Total subject codes $= P(1,1) \cdot P(1,1) \cdot P(26,1) \cdot P(10,4) \cdot P(2,1)$

$= (1)(1)(26)(10^4)(2)$

$= 520\ 000$ codes

(iii) All letters and digits are distinct:

Total subject codes $= P(26,1) \cdot P(25,1) \cdot P(24,1) \cdot P(10,1) \cdot P(9,1) \cdot P(8,1) \cdot P(7,1) \cdot P(6,1)$

$= (26)(25)(24)(10)(9)(8)(7)(6)$

$= 471\ 744\ 000$ codes

CHAPTER 3.2 (KAVI)

2. (i) $C(10,3) = 120$ ways

(ii) $C(15,9) = 5005$ ways

(iii) Total strings $= P(8,5)$

$= 8^5$

$= 32\ 768$ strings.

(iv) Select 2 girls: $C(10,2) = 45$ ways

Select 2 boys: $C(7,2) = 21$ ways

Select 2 girls and 2 boys $= (45)(21)$

$= 945$ ways

3. Select 3 permutation questions: $C(20,3) = 1140$ ways

Select 2 combination questions: $C(15,2) = 105$ ways

select 3 permutation questions and 2 combination questions

$= (1140)(105)$

$= 119\ 700$ ways

# Chapter 3 (3.4): Pigeonhole Principle

1. $n = 40$ (Pigeon – People)
   $k = 12$ (Pigeonhole – month)

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

   $m = \left\lceil \frac{40}{12} \right\rceil = 4$

   $\therefore$ at least 4 people

2. Possible score : 90 to 100
   = 11 numbers

   (Pigeon = number of students) $n = 35$
   (Pigeonhole = possible score) $k = 11$

   $m = \left\lceil \frac{n}{k} \right\rceil$
   $= \left\lceil \frac{35}{11} \right\rceil$
   $= 4$

3. To make sum of 2 numbers is 11, possible combinations are :
   $\{1,10\}, \{2,9\}, \{3,8\}, \{4,7\}, \{5,6\}$

   There is 5 possible combinations (Pigeonhole).
   If we had to pick 6 numbers (Pigeon), by the pigeonhole principle, at least one of the above combination must be chosen.
   Hence, at least 2 numbers will sum to 11.

4. Pigeonhole = time periods that can be schedule, $k = 53$.
   Pigeon = number of classes to be schedule, $n = 115$.
   To prevent overlapping of classes, minimum number of classroom required, $m = \left\lceil \frac{n}{k} \right\rceil$

   $= \left\lceil \frac{115}{53} \right\rceil$

   $= 3$

   $\therefore$ at least 3 rooms will be needed.

5. Pigeon : number of computer, $n = 25$

Pigeonhole : numbers of connection each computer can made

$= 1$ to $24$ connections (a computer can't connect to itself)

$k = 24$

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

$$= \left\lceil \frac{25}{24} \right\rceil$$

$$= 2$$

$\therefore$ hence, there are at least 2 computers in the network that are directly connected to same number of other computers according to Pigeonhole Principle.

Since there are 25 computers but only 24 possible connections.