**SECTION A**

**STRUCTURED : 2 Questions ( 25 marks each)**

**INSTRUCTION:**

This section consists of **TWO (2)** structured questions. Answer **ONE (1)** question only.

**QUESTION 1**

Table 1 below shows the weight of 40 durians as measured and recorded in kg.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1.0 | 1.4 | 1.7 | 1.0 | 1.3 | 2.6 | 1.5 | 2.8 |
| 1.0 | 3.0 | 2.9 | 1.8 | 2.0 | 1.6 | 1.2 | 1.9 |
| 1.4 | 2.1 | 1.5 | 2.1 | 1.5 | 2.2 | 2.4 | 1.9 |
| 2.0 | 3.0 | 2.2 | 2.0 | 1.6 | 1.9 | 2.1 | 2.5 |
| 2.2 | 2.1 | 2.7 | 2.3 | 2.0 | 1.7 | 1.1 | 1.6 |

Table 1: Weight of 40 Durians, in kg.

a) State the heaviest and lightest durian. CLO1:C1 (1 mark)

b) Determine the size and number of class interval. CLO1:C1 (2 marks)

c) Construct a frequency distribution table. CLO1:C2 (6 marks)

d) Draw an ogive graph by using a suitable scale. Hence, estimate the median weight, interquartile range and ninetieth percentile from the graph. CLO1:C2 (16 marks)



POLITEKNIK
Jabatan Pengajian Politeknik

EXAMINATION AND EVALUATION DIVISION
DEPARTMENT OF POLYTECHNIC EDUCATION
(MINISTRY OF HIGHER EDUCATION)

MATHEMATICS, SCIENCE & COMPUTER DEPARTMENT

FINAL EXAMINATION
JUNE 2012 SESSION

**BA301: ENGINEERING MATHEMATICS 3**

**DATE: 18 NOVEMBER 2012 (SUNDAY)**

**DURATION: 2 HOURS (2.30 PM – 4.30 PM)**

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This paper consists of **EIGHT (8)** pages including the front page.

Section A: Structured (2 question – answer **ONE (1)** question only)
Section B: Structured (4 questions – answer **THREE (3)** questions)

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(The CLO stated is for reference only)

## QUESTION 2

a) The frequency distribution for the systolic blood pressure readings (mmHg) of 200 randomly selected polytechnic students is shown in Table 2(a).

| Systolic Blood Pressure (mmHg) | Number of Students |
|---|---|
| 90 - 104 | 24 |
| 105 - 119 | 62 |
| 120 - 134 | 72 |
| 135 - 149 | 26 |
| 150 - 164 | 12 |
| 165 – 179 | 4 |

Table 2(a) : Systolic blood pressure readings of 200 polytechnic students

i. Find the mean CLO 1 : C2 (6 marks)

ii. Find the mode CLO 1 : C2 (3 marks)

iii. Find the $70^{th}$ percentile ($P_{70}$) CLO 1 : C2 (4 marks)





b) The data below are the length in meter of 6 rolls of ropes. Find the variance for these ropes. CLO 1 : C2 (5 marks)

35, 45, 30, 35, 40, 25

c) The mode and the mean of the set of data below are the same which is 15.

10, 15, 9, 24, $p$ , $q$

i. Determine the values of $p$ and $q$ where $p \neq q$. CLO 1 : C2 (5 marks)

ii. Find the median of the set of data. CLO 1 : C2 (2 marks)

## QUESTION 4

a) Find the sum of each of these Arithmetic Progression (APs) CLO2:C3

i. 2, 4, 6,……, 100. (4 marks)

ii. 19, 11, 3,….., -221. (4 marks)

b) The sum of the third and ninth term of an APs is 8. Find the sum of the first 11 terms of the progression. CLO2:C3 (4 marks)

c) Write down the term indicated in brackets in each of the following Geometric Progression (GPs).

i. -8, 16, -32,……(15$^{th}$ term) CLO2:C3 (3 marks)

ii. $x, x^2, x^3$,……(n$^{th}$ term) CLO2:C3 (3 marks)

d) Find the sum of the first six terms of GPs where the 3$^{rd}$ term is 16 and 6$^{th}$ term is 2. CLO2:C3 (7 marks)





## SECTION B

**STRUCTURED : 4 Questions ( 25 marks each)**

**INSTRUCTION:**

This section consists of **FOUR (4)** structured questions. Answer **THREE (3)** questions only.

## QUESTION 3

a) Given a function $y = \frac{1}{2x-2}$.

i. Complete Table 3a and give the answers correct to 4 decimal places. CLO 2 : C1 (3 marks)

| x | 2 | 2.5 | 3 | 3.5 | 4 | 4.5 | 5 |
|---|---|---|---|---|---|---|---|
| y | 0.5 | 0.3333 | | 0.2 | | | 0.125 |

Table 3a

ii. Based on the values in Table 3a, use the Trapezium's Rule to find the approximate value of $\int_2^5 \frac{1}{2x-2} dx$ with n = 6. Give your answer correct to 3 decimal places. CLO 2:C2 (7 marks)

b) Evaluate $\int_0^1 e^x \, dx$ using Simpson's Rule with the bandwidth of $\frac{1}{8}$. CLO 2 : C3 (15 marks)

## QUESTION 5

a) Given $A = \begin{bmatrix} -4 & 4 \\ 2 & -2 \end{bmatrix}, B = \begin{bmatrix} 6 & -7 \\ -6 & 7 \end{bmatrix}$ and $C = \begin{bmatrix} 1 & 0.5 \\ 0.5 & 1 \end{bmatrix}$

Find $[AC - B]^T$ CLO3: C2

(3 marks)

b) Given matrix of A = $\begin{bmatrix} 4 & 4 & -3 \\ 5 & 7 & -13 \\ 1 & 2 & -5 \end{bmatrix}$

i) Find the determinant of A CLO3: C2

(2 marks)

ii) Calculate the minor of A CLO3: C2

(4 marks)

iii) Determine the inverse matrix of A CLO3: C2

(4 marks)

c) Given the simultaneous linear equations as:

$$5x - y + 5z = 7$$

$$5x + y + 7z = 7$$

$$7x + 4y - z = 5$$

Determine the value of $x$, $y$ and $z$ by using the Cramer's Rule. CLO3: C2

(12 marks)





## QUESTION 6

a) Solve the simultaneous equation below by using the Crout - LU Decomposition Method to find the value of $s$, $t$ and $u$.

CLO3:C3

$$\begin{aligned} 2s - 5t + u &= 12 \\ 4s - t - u &= -8 \\ 3s - 4t + u &= 16 \end{aligned}$$

(15 marks)

b) Find the root correct to three decimal places for the equation $2x^2 - 3 = \frac{1}{x}$ with $x_0 = 1.5$ by using the Newton-Raphson Method.

CLO 3:C3

(10 marks)

# FORMULA OF ENGINEERING MATHEMATICS 3 (BA301)

1. Mean

$$\bar{x} = \frac{\sum x}{N} = \frac{\sum fx}{\sum f}$$

$$\text{Median} = L + \left[\frac{\frac{N}{2} - F}{f_m}\right]c$$

2. $\text{Mod e} = L + \left[\frac{d_1}{d_1 + d_2}\right]c$

3. $\text{Quartile}, Q_k = L + \left[\frac{\frac{k}{4}N - F}{f_{QK}}\right]c$

4. $\text{Decil}, D_k = L + \left[\frac{\frac{k}{10}N - F}{f_{DK}}\right]c$

5. $\text{Percentile}, P_K = L + \left[\frac{\frac{k}{100}N - F}{f_{PK}}\right]c$

6. Mean Deviation

i. $E = \frac{\sum|x - \bar{x}|}{n}$

ii. $E = \frac{\sum|x - \bar{x}|f}{n}$

7. Variance.

i. $s^2 = \frac{\sum(x - \bar{x})^2}{n}$

ii. $s^2 = \frac{\sum_{i=1}^{n} x_i^2 - n\bar{x}^2}{n}$

iii. $s^2 = \frac{\sum(x - \bar{x})^2 f}{n}$

iv. $s^2 = \frac{\sum fx^2}{\sum f} - \left[\frac{\sum fx}{\sum f}\right]^2$

8. Standard Deviation

$$s = \sqrt{\text{var}\,iance}$$

**Arithmetic Progression**

9. $T_n = a + (n-1)d$

10. $S_n = \frac{n}{2}[2a + (n-1)d]$

11. $T_n = \frac{T_{n-1} + T_{n+1}}{2}$

**Geometric Progression**

12. $T_n = ar^{n-1}$

13. $S_n = \frac{a(1-r^n)}{1-r} @ \frac{a(r^n - 1)}{r-1}$

14. $T_n = \sqrt{T_{n-1} \times T_{n+1}}$

**Matrix**

15. Inverse of Matrix

i. $A^{-1} = \frac{Adjoin(A)}{|A|} = \frac{C_a^t}{|A|}$

ii. Cofactor , $C = (-1)^{i-j}M_{ij}$

**Area of Irregular Shape**

16. Trapezoidal Rule

i. $\int_a^b f(x)dx = \frac{h}{2}(y_0 + 2y_1 + 2y_2 + \ldots\ldots + 2y_{n-1} + y_n)$

ii. $\int_a^b f(x)dx = h\left(\frac{1}{2}f(a) + f(x_1) + \ldots\ldots + f(x_{n-1}) + \frac{1}{2}f(b)\right)$

17. Simpson's Rule

i. $\int_a^b ydx = \frac{h}{3}(f_0 + 4f_1 + 2f_2 + 4f_3 + \ldots.. + 4f_{n-1} + f_n)$

ii. $\int_a^b f(x)dx = \frac{h}{3}\left(f(a) + 4\Sigma f(\text{odd number}) + 2\Sigma f(\text{even number}) + f(b)\right)$