STUDENT ID NO

SEAT NO

VENUE:____________________

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2017/2018

PMT0301 – MATHEMATICS III

(All sections/ Groups)

1st JUNE 2018
9.00 a.m. – 11.00 a.m.
(2 Hours)

Question	Marks
1	/10
2	/10
3	/10
4	/10
Total	/40

INSTRUCTIONS TO STUDENTS

1. This question paper consists of **NINE** printed pages excluding cover page and statistical table.
2. Answer **ALL** FOUR questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please write all your answers in the **QUESTION BOOKLET**. All necessary working steps **MUST** be shown.

Question 1

(a) Find the symmetric equations of the line passing through the point $(-2,5,1)$ that is parallel to $4i-3j+2k$ [2 marks]

Given a point: $(-2,5,1)$ and direction $\langle 4,-3,2\rangle$

Symmetric Equations

$$\frac{x+2}{4}=\frac{y-5}{-3}=\frac{z-1}{2}$$

(b) Find an equation of the plane that contains the line $x=2+4t$, $y=-2+3t$, $z=-t$ and is parallel to the plane $-x+3y+5z=10$. Give your final answer in the form of $ax+by+cz=d$. [3 marks]

Point on the plane: $(2,-2,0)$

Normal vector: $\langle -1,3,5\rangle$

$$\langle -1,3,5\rangle\cdot\langle x-2,y-(-2),z-0\rangle=0$$

$$-(x-2)+3(y+2)+5(z)=0$$

$$-x+2+3y+6+5z=0$$

$$-x+3y+5z=-8 \qquad \text{or} \qquad x-3y-5z=8$$

Continue…

(c) Expand $(2x-3y)^4$ using the Binomial Theorem. [2 marks]

$$(2x-3y)^4 = \binom{4}{0}(2x)^4 + \binom{4}{1}(2x)^3(-3y) + \binom{4}{2}(2x)^2(-3y)^2 + \binom{4}{3}(2x)^1(-3y)^3 + \binom{4}{4}(-3y)^4$$
$$= 16x^4 - 96x^3y + 216x^2y^2 - 216xy^3 + 81y^4$$

(d) Express $0.1\overline{23}$ as a fraction. [3 marks]

$$0.1\overline{23} = 0.1 + 0.0\overline{23}$$
$$0.0\overline{23} = 0.023 + 0.00023 + \ldots$$

For $0.0\overline{23}$

$$a = 0.023$$
$$r = \frac{0.00023}{0.023} = 0.01$$
$$S_\infty = \frac{a}{1-r} = \frac{0.023}{1-0.01} = \frac{23}{990}$$

Therefore

$$0.1\overline{23} = 0.1 + 0.0\overline{23}$$
$$= \frac{1}{10} + \frac{23}{990} = \frac{122}{990}$$

Continue…

Question 2

(a) Solve the system of linear equations with Gauss-Jordan Elimination method.

$$2x - y + 2z = 1$$
$$-6x - 2z = 0$$
$$8x - y + 5z = 4$$

[5 marks]

$$\left[\begin{array}{ccc|c} 2 & -1 & 2 & 1 \\ -6 & 0 & -2 & 0 \\ 8 & -1 & 5 & 4 \end{array}\right] \xrightarrow{R_1\left(\frac{1}{2}\right)} \left[\begin{array}{ccc|c} 1 & -\frac{1}{2} & 1 & \frac{1}{2} \\ -6 & 0 & -2 & 0 \\ 8 & -1 & 5 & 4 \end{array}\right]$$

$$\xrightarrow[R_3-8R_1->R_3]{R_2+6R_1->R_2} \left[\begin{array}{ccc|c} 1 & -\frac{1}{2} & 1 & \frac{1}{2} \\ 0 & -3 & 4 & 3 \\ 0 & 3 & -3 & 0 \end{array}\right]$$

$$\xrightarrow{R_2\left(\frac{-1}{3}\right)} \left[\begin{array}{ccc|c} 1 & -\frac{1}{2} & 1 & \frac{1}{2} \\ 0 & 1 & \frac{-4}{3} & -1 \\ 0 & 3 & -3 & 0 \end{array}\right]$$

$$\xrightarrow{R_3-3R_2->R_3} \left[\begin{array}{ccc|c} 1 & -\frac{1}{2} & 1 & \frac{1}{2} \\ 0 & 1 & \frac{-4}{3} & -1 \\ 0 & 0 & 1 & 3 \end{array}\right]$$

$$\xrightarrow[R_2+\left(\frac{4}{3}\right)R_3->R_2]{R_1-R_3->R_1} \left[\begin{array}{ccc|c} 1 & -\frac{1}{2} & 0 & -\frac{5}{2} \\ 0 & 1 & 0 & 3 \\ 0 & 0 & 1 & 3 \end{array}\right]$$

$$\xrightarrow{R_1+\frac{1}{2}R_2->R_1} \left[\begin{array}{ccc|c} 1 & 0 & 0 & -1 \\ 0 & 1 & 0 & 3 \\ 0 & 0 & 1 & 3 \end{array}\right]$$

x=-1, y=3, z=3

Continue…

(b) **[GIVE YOUR ANSWER CORRECT TO TWO DECIMAL PLACES.]**

Figure 1 is the ogive for the monthly cost of living (RM) in Cyberjaya by a random sample of 50 MMU students who stay in Cyberjaya. The breakdown of the cost living are accommodation, food and housekeeping, public transport, mobile phone bills and utilities, personal expenses, study materials and laundry.

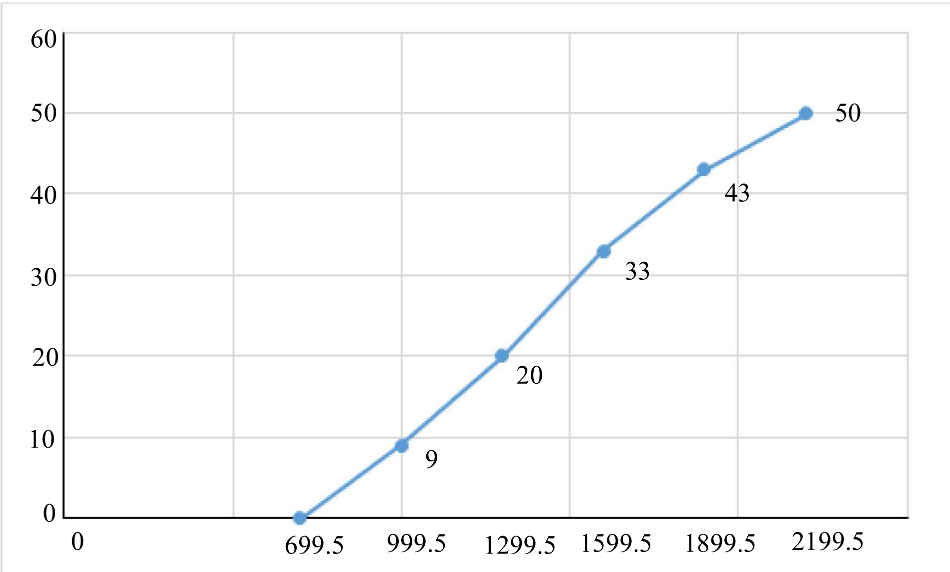


Figure 1. Ogive for monthly cost of living (RM) in Cyberjaya

(i) Based on Figure 1, construct a frequency table with five columns, class limit, midpoint (m), frequency (f), mf and $m^2 f$. [2.5 marks]

Class limit (RM)	Midpoint (m)	Frequency (f)	mf	$m^2 f$
700 – 999	849.5	9	7645.5	6494852.25
1000 – 1299	1149.5	11	12644.5	14534852.75
1300 – 1599	1449.5	13	18443.5	27313653.25
1600 – 1899	1749.5	10	17495	30607502.50
1900 - 2199	2049.5	7	14346.5	29403151.75
Total		50	70975	108354012.5

Continue…

(ii) Based on table in part (i), calculate the median and sample standard deviation. [2.5 marks]

$$\text{Median} = L + \left[\frac{\left(\frac{\sum f}{2}\right) - F_L}{f_m}\right] c$$

$$= 1299.5 + \left[\frac{\left(\frac{50}{2}\right) - 20}{13}\right](299)$$

$$= 1414.5$$

$$\text{Sample Standard Deviation, } s^2 = \sqrt{\frac{\sum m^2 f - \frac{\left(\sum mf\right)^2}{n}}{n-1}}$$

$$= \sqrt{\frac{108354012.5 - \frac{70975^2}{50}}{49}}$$

$$= \sqrt{155204.08}$$

$$= 393.96$$

Continue…

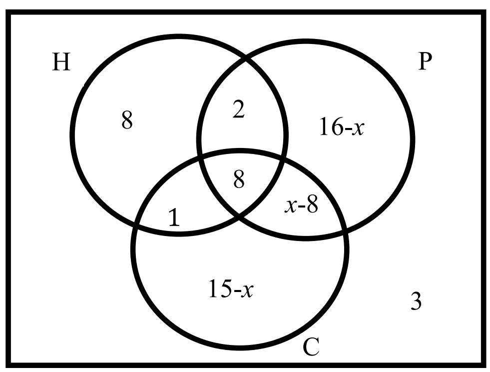
Question 3

(a) In a survey of 30 people, the following results were recorded:

3 people do not like pizza
19 people like hawaiian pizza
18 people like pepperoni pizza
16 people like cheese pizza
10 people like hawaiian and pepperoni pizza
9 people like hawaiian and cheese pizza
x people like pepperoni and cheese pizza
8 people like all three types of pizza

(i) Draw a Venn diagram to visualize the above information. [2 marks]

Let H – Hawaiian Pizza, P – Pepperoni Pizza, C – Cheese



(ii) Find the value of x from the Venn diagram obtained in part (i). [1.5 marks]

$$8+2+8+1+16-x+x-8+15-x+3=30$$
$$45-x=30$$
$$-x=-15$$
$$x=15$$

Continue…

(b) **[GIVE YOUR ANSWERS IN THE SIMPLEST FRACTION FORM.]**
100 students were asked whether they own car or call for Grab car service. Their responses are recorded in Table 1 below. Let A be the event of owning car and B be the event of calling for Grab car service.

	B	$\overline{B}$
A	7	30
$\overline{A}$	48	15

Table 1

(i) Find the probability of a person that owns car given that the person does not call for Grab car service. [1.5 marks]

(ii) Find the probability of a person that does not own car or has called for Grab car service. [1.5 marks]

(iii) Are the events A and B independent? Justify your answer. [3.5 marks]

(i) $P(A \mid \overline{B}) = \dfrac{P(A \cap \overline{B})}{P(\overline{B})}$

$$= \frac{30}{45}$$
$$= \frac{2}{3}$$

(ii) $P(\overline{A} \cup B) = P(\overline{A}) + P(B) - P(\overline{A} \cap B)$

$$= \frac{63}{100} + \frac{55}{100} - \frac{48}{100}$$
$$= \frac{70}{100}$$
$$= \frac{7}{10}$$

(iii) $P(A) = \dfrac{37}{100}$ $\quad P(B) = \dfrac{55}{100}$ $\quad P(A \cap B) = \dfrac{7}{100}$

$$P(A) \times P(B) = \frac{37}{100} \times \frac{55}{100} = \frac{407}{2000}$$

Since $P(A \cap B) \neq P(A)P(B)$, A and B are not independent.

Continue…

Question 4

(a) A biased coin lands tails up 55% of the time. If the coin is tossed 6 times,

(i) find the probability that less than 5 tails will occur. [2 marks]

(ii) determine the mean and standard deviation of the number of tails. [2 marks]

i) Let $X =$ number of tails

$n = 6 \quad p = 0.55 \quad X \sim Bin(6, 0.55)$

$P(X < 5)$

$= P(X \le 4)$

$= 1 - [P(X = 5) + P(X = 6)]$

$= 1 - \left[\binom{6}{5}(0.55^5)(0.45^1) + \binom{6}{6}(0.55^6)(0.45^0)\right]$

$= 1 - (0.1359 + 0.0277)$

$= 0.8364$

ii)

Mean, $\mu = np = 6 \times 0.55 = 3.3$

Standard deviation, $\mu = \sqrt{npq} = \sqrt{6 \times 0.55 \times 0.45} = \sqrt{1.485} = 1.2186$

(b) At the FCI parking lot, an average of 3 cars will be victims of bird droppings on any given workday. Find the probability that between 3 and 6 cars become the victims of bird droppings on two working days. [3 marks]

The average of bird droppings victim in two days time, $\lambda = 3 \times 2 = 6$

$P(3 < X < 6)$

$= P(X = 4) + P(X = 5)$

$= \frac{6^4 e^{-6}}{4!} + \frac{6^5 e^{-6}}{5!}$

$= 0.1339 + 0.1606$

$= 0.2945$

Continue…

(c) Siti fills boxes of soft drink at a factory. The weight, X kg, of each filled box is assumed to have a normal distribution with mean of $7.5kg$ and standard deviation of $0.1kg$. Find the weight of a box that is greater than 80% of all the filled boxes.

[3 marks]

$$X \sim N(7.5, 0.1)$$

$$P(X < a) = 0.80$$

$$P(Z < \frac{a - 7.5}{0.1}) = 0.80$$

$$\frac{a - 7.5}{0.1} = 0.84$$

$$a = 7.584kg$$

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