UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2017/2018

COURSE NAME	:	TECHNICAL MATHEMATICS III
COURSE CODE	:	DAS 21203
PROGRAMME	:	DAK
EXAMINATION DATE	:	DECEMBER 2017 / JANUARY 2018
DURATION	:	3 HOURS
INSTRUCTIONS	:	SECTION A) ANSWER **ALL** QUESTIONS SECTION B) ANSWER **THREE (3)** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **SEVEN (7)** PAGES

SECTION A

Q1 (a) The discrete random variable X has the probability distribution function

$$P(X = x) = \begin{cases} kx, & x = 2,4,6 \\ k(x-2), & x = 8 \\ 0, & else \end{cases}$$

(i) Find the value of constant k.

(2 marks)

(ii) Obtain the table of probability distribution of X.

(1 marks)

(iii) Find P $(3.3 < X < 9.9)$

(2 marks)

(iv) Find the expected value, $E(X)$.

(2 marks)

(v) Find $Var(X)$.

(3 marks)

(b) X is a continuous random variable with probability density function given by

$$f(x) = \begin{cases} c\,(9 - x^2), & 0 \le x \le 3 \\ 0, & else \end{cases}$$

where c is constant.

(i) Find the value of c.

(2 marks)

(ii) Find the cumulative distribution function of X.

(5 marks)

(iii) Show that the expected value, $E(X) = \frac{9}{8}$

(3 marks)

Q2 (a) A clothing store has determined that 15% of the people who enter the store will make a purchase. Ten people enter the store during a one-hour period. Find the probability that at least one person will make a purchase.

(3 marks)

(b) The mean number of students late to class per day is three. Find the

(i) probability exactly three students late to class per day.

(2 marks)

(ii) mean number of students late to class per week.

(2 marks)

(iii) probability at most two students late per week.

(3 marks)

(c) Statistics released by the National Highway Traffic Safety Administration show that on average 100 of all automobiles undergoing a headlight inspection with a variance of 64 failed the inspection. What is the probability that

(i) at most 85 of the automobiles failed the inspection.

(5 marks)

(ii) between 110 and 120 of the automobiles failed the inspection.

(5 marks)

SECTION B

Q3 (a) Let $\boldsymbol{a} = \boldsymbol{i} - 2\boldsymbol{j} + 2\boldsymbol{k}$, $\boldsymbol{b} = 3\boldsymbol{j} + 2\boldsymbol{k}$ and $\boldsymbol{c} = -4\boldsymbol{i} + \boldsymbol{j} - 3\boldsymbol{k}$. Find

(i) $\boldsymbol{a} \bullet \boldsymbol{b}$

(2 marks)

(ii) $\boldsymbol{b} \times \boldsymbol{c}$

(4 marks)

(iii) $(\boldsymbol{c} \times \boldsymbol{a}) \bullet \boldsymbol{b}$

(4 marks)

(b) Find an equation of the line that passes through $\boldsymbol{M}(2,3,5)$ and $\boldsymbol{N}(1,-1,-2)$.

(4 marks)

(c) Find the vector equation of the plane containing $\boldsymbol{P}(-1,2,1), \boldsymbol{Q}(0,-3,2)$ and $\boldsymbol{R}(1,1,-4)$.

(6 marks)

Q4 (a) If $v = 2 - 3i$ and $w = 3 + i$, express $z = \frac{2v+w}{w}$ in the form of $a + bi$.

(5 marks)

(b) Given $z_1 = 1 + i\sqrt{3}$ and $z_2 = 6 + 8i$.

(i) Express $\frac{z_1}{z_2}$ in polar form.

(6 marks)

(ii) Express $z_1 z_2$ in polar form.

(4 marks)

(c) Applying De Moivre's Theorem, calculate $\left(1 + i\sqrt{3}\right)^5$ in the form of $a + bi$.

(5 marks)

Q5 (a) The data shown are the number of grams per serving of 35 selected brands of nuts. Copy and complete the **Table Q5.**

Table Q5

Class limit	Lower boundary	x	f	$f_i x_i$	x_i^2	$f_i x_i^2$
1-19			13			
20-38			8			
39-57			6			
58-76			5			
77-95			3			
			$\sum =$	$\sum =$		$\sum =$

(6 marks)

(b) Find

(i) mean.

(2 marks)

(ii) mode

(3 marks)

(iii) median

(5 marks)

(iv) standard deviation

(4 marks)

Q6 (a) In my town, it's rainy one third of the days. Given that it is rainy, there will be heavy traffic with probability $\frac{1}{2}$, and given that it is not rainy, there will be heavy traffic with probability $\frac{1}{4}$. If it's rainy and there is heavy traffic, I arrive late for work with probability $\frac{1}{2}$. On the other hand, the probability of being late is reduced to $\frac{1}{8}$ if it is not rainy and there is no heavy traffic. In other situations (rainy and no traffic, not rainy and traffic) the probability of being late is 0.25. You pick a random day.

(i) Draw a tree diagram

(5 marks)

(ii) What is the probability that it's not raining and there is heavy traffic and I am not late?

(3 marks)

(iii) What is the probability that I am late?

(3 marks)

(iv) Given that I arrived late at work, what is the probability that it rained that day?

(5 marks)

(b) In an exam, two reasoning problems, 1 and 2 are asked. 35% students solved problem 1 and 15% students solved both the problems. What is the probability students who solved the first problem will also solve the second one?

(4 marks)

- END OF QUESTIONS –

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Table 1: Vector

$\lvert \boldsymbol{u} \rvert = \sqrt{a^2+b^2+c^2}$	$\hat{\boldsymbol{u}} = \dfrac{\boldsymbol{u}}{\lvert \boldsymbol{u} \rvert}$
$\boldsymbol{u} \bullet \boldsymbol{v} = u_1v_1 + u_2v_2 + u_3v_3$	$\boldsymbol{u} \bullet \boldsymbol{v} = \lvert \boldsymbol{u} \rvert \lvert \boldsymbol{v} \rvert \cos\theta$
$\theta = \cos^{-1}\left(\dfrac{\boldsymbol{u} \bullet \boldsymbol{v}}{\lvert \boldsymbol{u} \rvert \lvert \boldsymbol{v} \rvert}\right)$	$A = \dfrac{1}{2}\lvert \boldsymbol{u} \times \boldsymbol{v} \rvert$
$\boldsymbol{u} \times \boldsymbol{v} = (u_2v_3 - u_3v_2)\boldsymbol{i} - (u_1v_3 - u_3v_1)\boldsymbol{j} + (u_1v_2 - u_2v_1)\boldsymbol{k}$	
If plane equation is $ax+by+cz+d=0$ Then distance, $D = \left\lvert \dfrac{ax_0+by_0+cz_0+d}{\sqrt{a^2+b^2+c^2}} \right\rvert$	

Table 2: Complex Number

$z = a+bi$ $\bar{z} = a-bi$	$z = r(\cos\theta + i\sin\theta)$
$r = \sqrt{a^2+b^2}$	$\theta = \tan^{-1}\dfrac{b}{a}$
$z_1z_2 = r_1r_2[\cos(\theta_1+\theta_2) + i\sin(\theta_1+\theta_2)]$	
$\dfrac{z_1}{z_2} = \dfrac{r_1}{r_2}[\cos(\theta_1-\theta_2) + i\sin(\theta_1-\theta_2)]$	
$z = re^{i\theta}$	$z^n = r^n e^{in\theta}$
$z^{\frac{1}{n}} = r^{\frac{1}{n}} e^{\left(\frac{\theta+2k\pi}{n}\right)i}$	$z^n = r^n[\cos n\theta + i\sin n\theta]$
$z^{\frac{1}{n}} = r^{\frac{1}{n}}\left(\cos\dfrac{\theta+2k\pi}{n} + i\sin\dfrac{\theta+2k\pi}{n}\right)$	

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Table 3: Probability

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$	$P(A\|B) = \dfrac{P(A \cap B)}{P(B)}$

Table 4: Descriptive Statistics

$\mu = \dfrac{\sum_{i=1}^{n} x_i}{N}$	$\bar{x} = \dfrac{\sum_{i=1}^{n} x_i}{n}$
$\sigma^2 = \dfrac{\sum_{i=1}^{n}(x_i - \mu)^2}{N}$	$s^2 = \dfrac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}$
$s^2 = \dfrac{1}{\sum f - 1}\sum_{i=1}^{n} f_i(x_i - \bar{x})^2$ or	$s^2 = \dfrac{1}{\sum f - 1}[\sum_{i=1}^{n} f_i {x_i}^2 - \dfrac{(\sum f_i x_i)^2}{\sum f}]$
$M = L_m + C(\dfrac{\frac{n}{2} - F}{f_m})$	$M_0 = L + C(\dfrac{d_1}{d_1 + d_2})$

Table 5: Probability Distribution

Binomial $X \sim B(n,p) = \binom{n}{r} p^r (1-p)^{n-r}$ for $n = 0,1,\ldots,n$
Poisson $X \sim P_O(\mu) = \dfrac{e^{-\mu}\mu^r}{r!}$ for $\mu = 0,1,2 \ldots$
Normal $X \sim N(\mu, \sigma^2)$, $f(x) = \dfrac{1}{\sqrt{2\pi\sigma^2}} e^{-\left[\frac{(x-\mu)^2}{2\sigma^2}\right]}$
Standard Normal $Z \sim N(0,1)$, $f(z) = \dfrac{1}{\sqrt{2\pi}} e^{-\left[\frac{z^2}{2}\right]}$, $z = \dfrac{x-\mu}{\sigma}$