Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER III
SESSION 2018/2019

COURSE NAME	:	TECHNICAL MATHEMATICS III
COURSE CODE	:	DAS 21203
PROGRAMME CODE	:	DAK
EXAMINATION DATE	:	AUGUST 2019
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWERS **ALL** QUESTIONS IN SECTION A AND ANSWER **THREE (3)** QUESTIONS IN SECTION B

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

SECTION A

Q1 (a) Show that $f(x)=\dfrac{x^2}{55}$ for $x=1,2,3,4,5$ is a probability distribution function of a discrete random variable X.

(3 marks)

(b) Given the discrete random variable X has the following probability distribution function

$$g(x)=\begin{cases} 2px, & x=0,1,2 \\ px^2, & x=3,4 \end{cases},$$

where p is a constant.

(i) Show that $p=\dfrac{1}{31}$.

(3 marks)

(ii) Find $P(X>4)$.

(2 marks)

(iii) Find $P(1<X\leq 3)$.

(2 marks)

(c) X is a continuous random variable with the probability density function

$$f(x)=\begin{cases} kx, & 0\leq x<2 \\ k(4-x), & 2\leq x<4 \\ 0, & \text{otherwise} \end{cases},$$

where k is a constant.

(i) Find the value of the constant k.

(4 marks)

(ii) Determine the probability $P(1\leq X\leq 3)$.

(6 marks)

Q2 (a) When a customer places an order with Jaya's Online Office Supplies, a computerized accounting information system (AIS) automatically checks to see if the customer has exceeded his or her credit limit. Past record indicated that the probability of customers exceeding their credit limit is 0.35. Suppose that, on a given day, 20 customers place orders. Assume that X is the number of customers exceeding their credit limits with $X \sim B(20, 0.35)$.

(i) Compute the mean and standard deviation of the number of customers exceeding their credit limits.

(5 marks)

(ii) Calculate the probability that no customers exceed their credit limits.

(3 marks)

(b) Evidence shows that the automobile accident during a given year is binomially distributed with the probability of 0.01. A particular corporation employs 100 full time traveling sales reps. Calculate the probability that exactly two of the sales reps will be involved in a serious automobile accident during the coming year by using Poisson approximation.

(5 marks)

(c) The daily wages of worker in a construction firm are normally distributed with a mean of RM50 and a standard deviation of RM10. Find the value of p if 72% of the workers earn daily wages of more than RM p.

(7 marks)

SECTION B

Q3 (a) Given $\mathbf{u} = \mathbf{i} - 2\mathbf{j} + \mathbf{k}$, $\mathbf{v} = -4\mathbf{i} + 2\mathbf{j} - 5\mathbf{k}$ and $\mathbf{w} = 5\mathbf{i} - 6\mathbf{j} + \mathbf{k}$. Find

(i) $|3\mathbf{u} - 3\mathbf{v} - 2\mathbf{w}|$.

(4 marks)

(ii) $\mathbf{u} \bullet (\mathbf{v} \times \mathbf{w})$.

(5 marks)

(b) Find the symmetric vector equation of the line that passes through point $(0, 2, 4)$ and parallel to vector $2\mathbf{i} + \mathbf{j} + 3\mathbf{k}$.

(3 marks)

(c) Find the equation of the plane passing through point $P(-1, 2, 1)$, $Q(0, -3, 2)$ and $R(1, 1, -4)$. Hence find the distance between the plane and point $S(-6, 2, 3)$.

(8 marks)

Q4 (a) If $z_1 = -4+12i$ and $z_2 = 1-3i$. Determine

(i) $z_1 + 4z_2$,

(2 marks)

(ii) $z_1 z_2$.

(3 marks)

(b) Given $z_1 = \dfrac{3-i}{2+i}$.

(i) State the conjugate to be used for solving the above equation.

(1 marks)

(ii) Express z in $(a+ib)$ and polar form.

(6 marks)

(c) By using Euler form, find all the third root for $z = 4+4\sqrt{3}i$.

(8 marks)

Q5 **Table Q5** represents the weights in (kg) of iron rods.

Table Q5

Weights (kg)	Number of rods
118 - 126	3
127 - 135	5
136 - 144	9
145 - 153	12
154 - 162	5
163 - 171	4
172 - 180	2

(a) If x is the midpoint and f is the frequency, construct a table that contains class limit, class boundary, x, x^2, f, cumulative frequency, $f_i x_i$, $f_i x_i^2$, Σf, $\Sigma f_i x_i$, $\Sigma f_i x_i^2$.

(8 marks)

(b) Find the mean, median, mode, variance and standard deviation for the weights of the iron rods.

(12 marks)

Q6 (a) A bag contains 3 black balls, 4 white balls and 9 yellow balls. A ball is drawn randomly from the bag. Find the probability that the ball selected is black or yellow.

(3 marks)

(b) In a survey of 50 customers of a supermarket, 30 customers said they visited the supermarket because they read the advertisement in the local newspaper while the remaining 20 people did not read the advertisement. From the 28 respondents who made a purchase, 20 of them say that they have read the advertisement. Find the probability that

(i) the customer makes a purchase if he/ she has not read the advertisement.

(4 marks)

(ii) the customer makes a purchase after reading the advertisement.

(4 marks)

(c) Given that $P(A)=\frac{1}{6}, P(B)=\frac{1}{4}$ and $P(A\cup B)=\frac{1}{3}$. Determine $P(B\mid A)$.

(6 marks)

(d) A box contains 3 green marbles and 4 yellow marbles. A marble is randomly selected from the box, its colour is noted, and replaced. A second marble is then selected from the box. Find the probability that the first marble selected is green and the second marble is yellow.

(3 marks)

Q7 (a) The thickness of a metal strip made by a machine follows a normal distribution with mean 4.3mm and variance 0.15mm.

(i) Find the probability that the thickness of the metal strip is at most 4.6mm.

(4 marks)

(ii) A metal strip would be rejected if the thickness is out of the specification limits between 4.1mm and 4.5mm. If the machine produces 300 strips a day, find the number of the strips are expected to be rejected.

(6 marks)

(b) 45% of all students in UTHM own a bicycles. A sample of 200 students were chosen randomly.

(i) Show that normal distribution can be used as an approximation to this binomial distribution. Hence, find the mean and standard deviation.

(5 marks)

(ii) By approximating with a normal distribution, find the probability that at least 100 of them own a bicycle.

(5 marks)

- END OF QUESTION -

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Table 1: Vector

$\lvert\mathbf{u}\rvert = \sqrt{a^2+b^2+c^2}$	$\hat{\mathbf{u}} = \dfrac{\mathbf{u}}{\lvert\mathbf{u}\rvert}$
$\mathbf{u}\bullet\mathbf{v} = u_1v_1 + u_2v_2 + u_3v_3$	$\mathbf{u}\bullet\mathbf{v} = \lvert\mathbf{u}\rvert\lvert\mathbf{v}\rvert\cos\theta$
$\theta = \cos^{-1}\left(\dfrac{\mathbf{u}\bullet\mathbf{v}}{\lvert\mathbf{u}\rvert\lvert\mathbf{v}\rvert}\right)$	$A = \dfrac{1}{2}\lvert\mathbf{u}\times\mathbf{v}\rvert$
$\mathbf{u}\times\mathbf{v} = (u_2v_3 - u_3v_2)\mathbf{i} - (u_1v_3 - u_3v_1)\mathbf{j} + (u_1v_2 - u_2v_1)\mathbf{k}$	
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

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

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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 $Z \sim N(0,1)$, $f(z) = \dfrac{1}{\sqrt{2\pi}} e^{-\left[\frac{z^2}{2}\right]}$, $z = \dfrac{x-\mu}{\sigma}$