Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2019/2020

COURSE NAME	:	PROBABILITY AND STATISTICS I
COURSE CODE	:	BWB 10403
PROGRAMME CODE	:	BWA / BWQ
EXAMINATION DATE	:	DECEMBER 2019 / JANUARY 2020
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWERS **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **SIX (6)** PAGES

Q1 A testing technician wishes to test two experimental brands of outdoor paint to see how long each will last before fading. The testing lab makes 10 gallons of each paint to test. Since different chemical agents are added to each group and only 10 cans are involved, these two groups constitute two small populations. The results (in months) are shown in **Table Q1** below.

Table Q1 : Results (in months) for the outdoor paint before fading

Brand A	Brand B
35	45
30	50
57	67
60	48
68	60
70	46
66	56
46	51
30	45
76	70

(a) Compute the variations of each brand in terms of mean and standard deviation. (4 marks)

(b) Compare and interpret your answers in **Q1 (a)**. (2 marks)

(c) Calculate the months for each brand range for which at least 75% of the paints will fading. (6 marks)

(d) Interpret your results in **Q1 (c)**. (2 marks)

(e) Construct a box plot for each brand. (9 marks)

(f) Compare the distribution from your box plots in **Q1 (e)**. (2 marks)

Q2 (a) The data in **Table Q2 (a)** shows the number of computer sold (in thousands) and their price (in RM) from 2015 until 2017

Table Q2 (a) : The number of computer sold (in thousands) and price (in RM)

Computer \ Year	2015		2016		2017	
	Price	Sales	Price	Sales	Price	Sales
Brand *A*	2800	20	2900	18	3000	21
Brand *B*	3000	21		30	3500	27
Brand *C*	4500	10	4550	15	4650	14
Brand *D*	3200	10	3250	15	3500	16
Brand *E*	3000		3100	12	3200	16

(i) Given that the price index of computer brand B for 2016 based on 2015 is 110, calculate the price of computer brand B in 2016.

(3 marks)

(ii) Compute the aggregate price index for 2016 and 2017 based on 2015. Interpret your results.

(5 marks)

(iii) If the Laspeyres index for the year 2017 based on the year 2016 is 109.04, find the quantity of computer brand E is sold in 2015.

(5 marks)

(b) County Bicycles makes two mountain bike models that each model comes in three colours. The following **Table Q2 (b)** shows the production volumes for the last week.

Table Q2 (b) : The mountain bike production volumes

	Colour		
Model	Blue	Brown	White
XB-50	302	105	200
YZ-99	40	205	130

(i) Based on the relative frequency assessment method, compute the probability that a manufactured item is brown.

(2 marks)

(ii) Obtain the joint probability that a product manufactured is an YZ-99 and blue.

(2 marks)

(iii) Suppose a white mountain bike was chosen at random, calculate the percentage the model XB-50 is being chosen.

(5 marks)

(iv) Consider two events: the event that model XB-50 was chosen and the event that a white product was chosen. Are these two events mutually exclusive? Explain.

(3 marks)

Q3 (a) The actual amount of milk (in litre) in a 5-litre bottle filled by a factory machine has the probability density as below.

$$f(y)=\begin{cases}0 & y<4.5,\\ k(y+1) & 4.5<y<4.9,\\ 1 & y>4.9.\end{cases}$$

(i) Find the value of k.

(5 marks)

(ii) Compute the probability of the amount of milk is less than 4.87 litres.

(6 marks)

(iii) Calculate the probability of the amount of milk in the bottle is between 4.6 to 4.9 litres.

(6 marks)

(b) Certain coded measurements of the pitch diameter of threads of fitting have the probability density

$$f(x)=\begin{cases}\dfrac{4}{\pi(1+x^2)} & 0<x<1,\\ 0 & \text{elsewhere.}\end{cases}$$

Find the expected value of this coded measurement.

(8 marks)

Q4 (a) In the inspection of a fabric produced in continuous rolls, the number of imperfections per yard is a random variable having the Poisson distribution with $\lambda = 0.35$.

(i) Find the probability that two yards of the fabric will be at most three imperfections.

(4 marks)

(ii) Calculate the probability that ten yards of the fabric will be at least ten imperfections.

(3 marks)

(iii) Compute the probability that five yards will be less than five imperfections.

(4 marks)

(iv) List the conditions Poisson approximation to the binomial distribution.

(2 marks)

(b) The average time for a group of students to complete a Calculus test is 55.2 minutes. The standard deviation is 10 minutes. Assume the variable is normally distributed.

(i) Find the probability that randomly selected students will complete the Calculus test in less than 50 minutes.

(5 marks)

(ii) Compute the probability if 44 randomly selected students that took the Calculus test, the meantime they will complete the Calculus test will be less than 50 minutes.

(5 marks)

(iii) Does it seem reasonable that the mean of these 44 students will complete the Calculus test in less than 50 minutes? Explain.

(2 marks)

- END OF QUESTIONS -

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FORMULA

$$\tilde{x} = L_B + \left(\frac{\frac{(\sum f_i)+1}{2} - F_B}{f_m} \right) \times C$$

$$\hat{x} = L_B + \left(\frac{\Delta_B}{\Delta_B + \Delta_A} \right) \times C$$

$$Q = L_B + \left(\frac{\frac{n+1}{4} - F_B}{f_m} \right) \times C$$

$$\sigma^2 = \frac{1}{N}\sum_{i=1}^{N}(x_i - \mu)^2$$

$$\sigma^2 = \frac{1}{N}\sum_{i=1}^{N}x_i^2 - \left(\frac{1}{N}\sum_{i=1}^{N}x_i\right)^2$$

$$\sigma^2 = \frac{1}{N}\left[\sum_{i=1}^{N}f_i x_i^2 - \frac{1}{N}\left(\sum_{i=1}^{N}f_i x_i\right)^2\right]$$

$$I_t = \frac{y_t}{y_0} \times 100$$

$$I_t = \frac{\sum p_t}{\sum p_0} \times 100$$

$$\Pr(A \cup B) = \Pr(A) + \Pr(B) - \Pr(A \cap B)$$

$$\Pr(A \cap B) = \Pr(B) \times \Pr(A \mid B)$$

$$E(X) = \int_{-\infty}^{\infty} x f(x)dx$$

$$F(x) = \Pr(X \le x) = \int_{-\infty}^{\infty} f(x)dx$$

$$\int_{-\infty}^{\infty} f(x)dx = 1$$

$$\sum_{i=1}^{n}\Pr(X_i) = 1$$

$$\Pr(X = r) = \frac{e^{-\mu}\mu^r}{r!}$$

$$\Pr(X = r) = \binom{n}{r} p^r (1-p)^{n-r}$$

$$V_Q = \frac{|Q_3 - Q_1|}{|Q_3 + Q_1|}$$

$$\frac{1}{n}\sum_{i=1}^{n}|x_i - \bar{x}|$$

$$\frac{1}{\sum_{i=1}^{n} f_i}\left(\sum_{i=1}^{n} f_i |x_i - \bar{x}|\right)$$

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

$$s^2 = \frac{1}{n-1}\left[\sum_{i=1}^{n}f_i x_i^2 - \frac{1}{n}\left(\sum_{i=1}^{n}f_i x_i\right)^2\right]$$

$$s^2 = \frac{1}{n-1}\left[\sum_{i=1}^{n}x_i^2 - \frac{1}{n}\left(\sum_{i=1}^{n}x_i\right)^2\right]$$

$$I_t = \frac{\sum q_0 p_t}{\sum q_0 p_0} \times 100$$

$$I_t = \frac{\sum q_t p_t}{\sum q_t p_0} \times 100$$

$$\Pr(A \cap B) = \frac{n(A \cap B)}{n(S)}$$

$$E(X) = \sum_{i=1}^{n} x_i \times \Pr(X = x_i)$$

$$F(x) = \Pr(X \le x) = \sum_{-\infty}^{x}\Pr(X = x)$$

$$Var(X) = E(x^2) - [E(x)]^2$$

$$Var(X) = E[(x-\mu)^2]$$

$$Z = \frac{x - \mu}{\sigma} \sim Z_\alpha$$

$$Z = \frac{\bar{x} - \mu}{\sigma / \sqrt{n}} \sim Z_\alpha$$