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Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2018/2019

COURSE NAME	:	STATISTICS
COURSE CODE	:	BIC 10603
PROGRAMME CODE	:	BIS / BIP / BIW / BIM
EXAMINATION DATE	:	JUNE / JULY 2019
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS.

THIS MARKING SCHEME CONSISTS OF **SEVEN (7)** PAGES

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Q1 (a) The following data contain the marks obtained by 50 students of a class, which are given below:

23, 50, 38, 42, 63, 75, 12, 33, 26, 39,
35, 47, 43, 52, 56, 59, 64, 77, 15, 21,
51, 54, 72, 68, 36, 65, 52, 60, 27, 34,
47, 48, 55, 58, 59, 62, 51, 48, 50, 41,
57, 65, 54, 43, 56, 44, 30, 46, 67, 53

(i) Construct a frequency distribution with the suitable class interval size of marks.

(3 marks)

(ii) Based on answer Q1 (a), Calculate mean and median.

(5 marks)

(b) (i) The random variable X has probability distribution given in the **Table Q1** below. Given that E(X) = 0.55.

Table Q1: Random variable probability distribution

x	-1	0	1	2	3
$P(X = x)$	p	q	0.2	0.15	0.15

Find the value of p and the value of q.

(3 marks)

(ii) The random variable X has a probability density function, $f(x)$ where

$$f(x) = \begin{cases} a - 5 + x \ ; & 5 \le x \le 6 \\ 0 \ ; & \text{otherwise} \end{cases}$$

(a) Show that $a = \frac{1}{2}$.

(2 marks)

(b) Calculate $P(X > 5.7)$.

(3 marks)

(c) Find E(X) and Var(X).

(4 marks)

Q2 (a) There was a probability of 0.8 of success in exam statistic. This often depended on student understanding.

(i) Calculate the probability of having 7 successes in 10 attempts

(5 marks)

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(ii) If in a class have 7 students, find the probability of having more female students than male students given that the probability of having a male or a female students is equal.

(7 marks)

(b) There are five staffs in ABC company and the number of staff who will participate in annual day every year is a Poisson random variable with mean 3. What will be the probability of more than 3 staffs participating in annual day this year?

(8 marks)

Q3 (a) The height of adult females are normally distributed with mean 160 cm and standard deviation 8 cm.

(i) Estimate the probability that a randomly selected adult female has a height greater than 170 cm.

(3 marks)

(ii) Any adult female whose height is greater than 170 cm is define as tall. An adult female is chosen at random. Given that she is tall, compute the probability that she has height greater than 180 cm.

(3 marks)

(iii) The result of Statistics test for two groups of students, Section A and Section B are normally distributed with $N(60, 4^2)$ and $N(64, 2^2)$ respectively. Two samples of size 9 from Section A and size 12 from Section B are randomly selected. Calculate the probability that the mean of Section B is lower than the mean of Section A?

(5 marks)

(b) The mean yield of a chemical process is being research by an engineer. From previous experience with this process the standard deviation of yield is known to be 3. He would like to be 99% confident that the estimate point should be accurate within yield point with the value of one.

(i) Examine the error and then analyze how large a sample is necessary for this research?

(4 marks)

(ii) Suppose that an engineer reduced the sample size to 20. If it was found that the sample mean is 10 and a standard deviation of 1.6, find a 99% confidence interval for the mean yeild.

(5 marks)

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Q4 (a) A teacher wishes to study the amount of time students in his statistics course spend each week in study for the course. He believes that the average should be the nominal 6 hours (two hours outside class for every hour in class). So he has the students keep track of and report the time spent in study during a typical week. A total of 7 students respond. The average time spent is 6.5 hours with a standard deviation of 2 hours. With this information he wishes to perform a hypothesis test. Identify the values for each of the following relevant variables. (If a value is not given, then state "not given".)

(i) μ
(ii) σ
(iii) n
(iv) $\bar{x}$
(v) s

(5 marks)

(b) An ice cream company claimed that its product contain on average 500 calories per pint. Analyzed the claim if 24 pint containers were tested, giving the mean is 507 calories and standard deviation of 21 calories at 1% level of significance.

(7 marks)

(c) A manufacturer of car batteries claims that the life of his batteries is normally distributed with a standard deviation equal to 0.7 year. If a random sample of 15 of these batteries has a standard deviation of 0.5 years, test the hypothesis of variance population greater than 0.49 year by using 0.01 of significance level.

(8 marks)

Q5 An experiment was conducted to determine the weight of an animal after a given period of time on the basis of the animal initial weight and the amount of food that was eaten. The following data measured in kilograms are recorded.

Table Q5: The measurements of mousedeer

Initial weight	42	33	33	45	39	36
Food weight	272	226	259	292	311	183

(a) Construct a scatter plot of the data in **Table Q5**. Then show the data in a data array.

(4 marks)

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(b) Calculate the sample mean $\bar{x}_1$ and $\bar{x}_2$, the sample variances S_{11} and S_{22}, and the sampel, covariance S_{12}.

(10 marks)

(c) Compute the sample correlation coefficient r_{12} and interpret the result.

(6 marks)

- END OF QUESTIONS–

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Formula

Special Probability Distributions :

$P(x=r)={}^{n}C_r \cdot p^r \cdot q^{n-r},\ r=0,1,\ldots,n,\ X\sim B(n,p),\ P(X=r)=\dfrac{e^{-\mu}\cdot \mu^r}{r!},\ r=0,1,\ldots,\infty,$

$X\sim P_0(\mu),\ Z=\dfrac{X-\mu}{\sigma},\ Z\sim N(0,1),\ X\sim N(\mu,\sigma^2).$

Sampling Distributions :

$\bar{X}\sim N(\mu,\sigma^2/n),\ Z=\dfrac{\bar{X}-\mu}{\sigma/\sqrt{n}}\sim N(0,1),\ T=\dfrac{\bar{x}-\mu}{s/\sqrt{n}},\ \bar{X}_1-\bar{X}_2\sim N\left(\mu_1-\mu_2,\dfrac{\sigma_1^2}{n_1}+\dfrac{\sigma_2^2}{n_2}\right).$

Estimations :

$n=\left(\dfrac{Z_{\alpha/2}\cdot\sigma}{E}\right)^2,\quad \bar{x}\pm z_{\alpha/2}(\sigma/\sqrt{n}),\quad \bar{x}\pm z_{\alpha/2}(s/\sqrt{n}),\quad \bar{x}\pm t_{\alpha/2,v}\left(\dfrac{s}{\sqrt{n}}\right)$

$\left(\bar{x}_1-\bar{x}_2\right)-Z_{\alpha/2}\sqrt{\dfrac{\sigma_1^2}{n_1}+\dfrac{\sigma_2^2}{n_2}}<\mu_1-\mu_2<\left(\bar{x}_1-\bar{x}_2\right)+Z_{\alpha/2}\sqrt{\dfrac{\sigma_1^2}{n_1}+\dfrac{\sigma_2^2}{n_2}},$

$\left(\bar{x}_1-\bar{x}_2\right)-Z_{\alpha/2}\sqrt{\dfrac{s_1^2}{n_1}+\dfrac{s_2^2}{n_2}}<\mu_1-\mu_2<\left(\bar{x}_1-\bar{x}_2\right)+Z_{\alpha/2}\sqrt{\dfrac{s_1^2}{n_1}+\dfrac{s_2^2}{n_2}},$

$\left(\bar{x}_1-\bar{x}_2\right)-t_{\alpha/2,v}\cdot S_p\sqrt{\dfrac{2}{n}}<\mu_1-\mu_2<\left(\bar{x}_1-\bar{x}_2\right)+t_{\alpha/2,v}\cdot S_p\sqrt{\dfrac{2}{n}};v=2n-2$

$\left(\bar{x}_1-\bar{x}_2\right)-t_{\alpha/2,v}\cdot S_p\sqrt{\dfrac{1}{n_1}+\dfrac{1}{n_2}}<\mu_1-\mu_2<\left(\bar{x}_1-\bar{x}_2\right)+t_{\alpha/2,v}\cdot S_p\sqrt{\dfrac{1}{n_1}+\dfrac{1}{n_2}}$

where Pooled estimate of variance, $S_p^2=\dfrac{(n_1-1)s_1^2+(n_2-1)s_2^2}{n_1+n_2-2}$ with $v=n_1+n_2-2$,

$\left(\bar{x}_1-\bar{x}_2\right)-t_{\alpha/2,v}\sqrt{\dfrac{1}{n}\left(s_1^2+s_2^2\right)}<\mu_1-\mu_2<\left(\bar{x}_1-\bar{x}_2\right)+t_{\alpha/2,v}\sqrt{\dfrac{1}{n}\left(s_1^2+s_2^2\right)}$ with $v=2(n-1)$,

$\left(\bar{x}_1-\bar{x}_2\right)-t_{\alpha/2,v}\sqrt{\dfrac{s_1^2}{n_1}+\dfrac{s_2^2}{n_2}}<\mu_1-\mu_2<\left(\bar{x}_1-\bar{x}_2\right)+t_{\alpha/2,v}\sqrt{\dfrac{s_1^2}{n_1}+\dfrac{s_2^2}{n_2}}$ with $v=\dfrac{\left(\dfrac{s_1^2}{n_1}+\dfrac{s_2^2}{n_2}\right)^2}{\dfrac{\left(\dfrac{s_1^2}{n_1}\right)^2}{n_1-1}+\dfrac{\left(\dfrac{s_2^2}{n_2}\right)^2}{n_2-1}}$,

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Formula

$$\frac{(n-1)\cdot s^2}{\chi^2_{\alpha/2,v}} < \sigma^2 < \frac{(n-1)\cdot s^2}{\chi^2_{1-\alpha/2,v}} \text{ with } v = n-1,$$

Hypothesis Testing :

$$Z_{Test} = \frac{\bar{x}-\mu}{\sigma/\sqrt{n}},\quad Z_{Test} = \frac{\bar{x}-\mu}{s/\sqrt{n}},\quad T_{Test} = \frac{\bar{x}-\mu}{s/\sqrt{n}}$$

$$Z = \frac{(\bar{X}_1-\bar{X}_2)-(\mu_1-\mu_2)}{\sqrt{\frac{\sigma_1^2}{n_1}+\frac{\sigma_2^2}{n_2}}},\quad T = \frac{(\bar{X}_1-\bar{X}_2)-(\mu_1-\mu_2)}{S_p\cdot\sqrt{\frac{1}{n_1}+\frac{1}{n_2}}} \text{ with } v = n_1+n_2-2,$$

$$Z = \frac{(\bar{X}_1-\bar{X}_2)-(\mu_1-\mu_2)}{\sqrt{\frac{s_1^2}{n_1}+\frac{s_2^2}{n_2}}},\quad T = \frac{(\bar{X}_1-\bar{X}_2)-(\mu_1-\mu_2)}{\sqrt{\frac{1}{n}\left(s_1^2+s_2^2\right)}},\quad T = \frac{(\bar{X}_1-\bar{X}_2)-(\mu_1-\mu_2)}{\sqrt{\frac{s_1^2}{n_1}+\frac{s_2^2}{n_2}}} \text{ with}$$

$$v = \frac{\left(\frac{s_1^2}{n_1}+\frac{s_2^2}{n_2}\right)^2}{\frac{\left(\frac{s_1^2}{n_1}\right)^2}{n_1-1}+\frac{\left(\frac{s_2^2}{n_2}\right)^2}{n_2-1}}.\ ;\ S_p^2 = \frac{(n_1-1)s_1^2+(n_2-1)s_2^2}{n_1+n_2-2}\ ;\ \chi^2 = \frac{(n-1)s^2}{\sigma^2}$$

$$F = \frac{s_1^2}{s_2^2},\quad \text{with } \frac{1}{f_{\alpha/2}(v_2,v_1)} \quad \text{and} \quad f_{\alpha/2}(v_1,v_2)$$

Simple Linear Regressions :

$$S_{xy} = \sum x_i y_i - \frac{\sum x_i\cdot\sum y_i}{n},\ S_{xx} = \sum x_i^2 - \frac{\left(\sum x_i\right)^2}{n},\ S_{yy} = \sum y_i^2 - \frac{\left(\sum y_i\right)^2}{n},\ \bar{x} = \frac{\sum x}{n},\ \bar{y} = \frac{\sum y}{n},$$

$$\hat{\beta}_1 = \frac{S_{xy}}{S_{xx}},\ \hat{\beta}_0 = \bar{y}-\hat{\beta}_1\bar{x},\ \hat{y} = \hat{\beta}_0+\hat{\beta}_1 x,\ r = \frac{S_{xy}}{\sqrt{S_{xx}\cdot S_{yy}}},\ SSE = S_{yy}-\hat{\beta}_1 S_{xy},\ MSE = \frac{SSE}{n-2}.$$

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