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Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2018/2019

COURSE NAME	:	PROBABILITY AND STATISTICS II
COURSE CODE	:	BWB 10503 / BWB 10303
PROGRAMME CODE	:	BWA
EXAMINATION DATE	:	DECEMBER 2018 / JANUARY 2019
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWERS **ALL** QUESTIONS

TERBUKA

THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

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Q1 (a) In a certain city too many accidents occur every year, so the motor vehicle department has been quite strict about passing the persons who take their driving test. The probabilities that a person who takes this test will pass in the first, second or third attempt are 0.25, 0.30 and 0.45, respectively. Calculate the probability that among the nineteen persons who take the test, four will pass in the first attempt, five in the second, and the rest of these nineteen in the third attempt?

(4 marks)

(b) A manager of a manufacturing company has eight female and twelve male engineers in her department. The manager randomly selected a team of six engineers to attend a business meeting. Calculate the probability that the team had

(i) two female engineers.

(5 marks)

(ii) at least two male engineers.

(6 marks)

(c) Suppose that the time T (in hours) needed to repair a water pump can be modeled as gamma with $\alpha = 2$ and $k = 2$. Calculate the probability that the next repair of water pump will need at most two hours. Then, find the mean of time.

(10 marks)

Q2 (a) Suppose that the mean hourly wage of all employees in a large semiconductor manufacturing facility is RM50.00 with a standard deviation of RM10.00. Let $\overline{X}$ be the mean hourly wages of certain employees selected randomly from all the employees of this manufacturing facility. When the number of selected employees is 100,

(i) find the mean and standard deviation of the sampling distribution of $\overline{X}$.

(3 marks)

(ii) compute the probability that the mean hourly wages $\overline{X}$ falls between RM48.00 and RM53.00.

(6 marks)

(b) Two levels (low and high) of insulin doses are given to two groups of diabetic rats to check the insulin-binding capacity, yielding the following data

Low dose :	$n_1 = 8$	$\bar{x}_1 = 1.98$	$s_1 = 0.51$
High dose :	$n_2 = 13$	$\bar{x}_2 = 1.30$	$s_2 = 0.35$

If the variances of the populations are equal, calculate a 95% confidence interval for the difference in the true average insulin-binding capacity between two samples. Interpret your result.

(16 marks)

Q3 The athletic department of a large school randomly selects two groups of 50 students each. The first group is chosen from students who voluntarily engage in athletics, the second group is chosen from students who do not engage in athletics. Their body weights are measured with the following results.

Athletes :	$n_1 = 13$	$\bar{x}_1 = 158.26\ lb$	$s_1 = 7.08\ lb$
Not athletes :	$n_2 = 25$	$\bar{x}_2 = 151.47\ lb$	$s_2 = 7.92\ lb$

(a) Compute a 90% confidence interval for the standard deviation of students who voluntarily engage in athletics.

(12 marks)

(b) Calculate a 95% confidence interval for the ratio of the population variances.

(13 marks)

Q4 The Lazer Company has a contract to produce a part for Boeing Corporation that must have an average diameter of 6 inches and a standard deviation of 0.2 inches. The Lazer Company has developed the process that will meet the specifications with respect to the standard deviation, but it is still trying to meet the mean specifications. A test run (considered a random sample) of parts was produced, and the company wishes to determine whether this latest process that produced the sample will produce parts meeting the requirement of an average diameter equal to 6 inches.

(a) Point out the appropriate null and alternative hypotheses.

(4 marks)

(b) Identify either the hypothesis tests a left-tailed, right-tailed or two-tailed test.

(1 mark)

(c) Develop the rejection region if the test using a 0.01 level of significance.

(5 marks)

(d) What should the company conclude if the sample mean diameter for the 100 parts is 6.07 inches?

(9 marks)

(e) Calculate the power of the test.

(6 marks)

- END OF QUESTIONS -

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FORMULA

$$f(x)=\begin{cases}\dfrac{1}{\beta^{\alpha}\Gamma(\alpha)}x^{\alpha-1}e^{-x/\beta} & x>0\\ 0 & \text{elsewhere}\end{cases}$$

$$f(x)=\begin{cases}\dfrac{1}{\Gamma(\alpha)}k^{\alpha}x^{\alpha-1}e^{-kx} & x>0\\ 0 & \text{elsewhere}\end{cases}$$

$$f(x)=\begin{cases}\dfrac{1}{b-a} & a\le x\le b\\ 0 & \text{elsewhere}\end{cases}$$

$$f(x)=\begin{cases}\dfrac{1}{\beta}e^{-x/\beta} & x>0\\ 0 & \text{elsewhere}\end{cases}$$

$$f(x)=\frac{\Gamma(\alpha+\beta)}{\Gamma(\alpha)\Gamma(\beta)}x^{\alpha-1}(1-x)^{\beta-1}$$

$$f(x)=p(1-p)^{x-1}$$

$$\Pr(X=x)=\frac{{}^{r}C_{x}\,{}^{N-r}C_{n-x}}{{}^{N}C_{n}}$$

$$E(X)=\alpha\beta \qquad Var(X)=\alpha\beta^2$$

$$E(X)=\frac{a+b}{2} \qquad Var(X)=\frac{1}{12}(b-a)^2$$

$$E(X)=\frac{1}{p} \qquad Var(X)=\frac{1-p}{p^2}$$

$$E(X)=\beta \qquad Var(X)=\beta^2$$

$$E(X)=\frac{nr}{N} \qquad E(X)=\frac{\alpha}{\alpha+\beta}$$

$$Var(X)=\frac{r(N-r)n(N-n)}{N^2(N-1)}$$

$$Var(X)=\frac{\alpha\beta}{(\alpha+\beta)^2(\alpha+\beta+1)}$$

$$Z=\frac{(\bar{x}_1-\bar{x}_2)-(\mu_1-\mu_2)}{\sqrt{\dfrac{\sigma_1^2}{n_1}+\dfrac{\sigma_2^2}{n_2}}}\sim Z_\alpha$$

$$Z=\frac{(\bar{x}_1-\bar{x}_2)-(\mu_1-\mu_2)}{\sqrt{\dfrac{s_1^2}{n_1}+\dfrac{s_2^2}{n_2}}}\sim Z_\alpha$$

$$T=\frac{(\bar{x}_1-\bar{x}_2)-(\mu_1-\mu_2)}{\sqrt{\dfrac{1}{n}(s_1^2+s_2^2)}}\sim T_\alpha(v)$$

$$T=\frac{(\bar{x}_1-\bar{x}_2)-(\mu_1-\mu_2)}{S_p\sqrt{\dfrac{1}{n_1}+\dfrac{1}{n_2}}}\sim T_\alpha(v)$$

$$T=\frac{(\bar{x}_1-\bar{x}_2)-(\mu_1-\mu_2)}{\sqrt{\dfrac{s_1^2}{n_1}+\dfrac{s_2^2}{n_2}}}\sim T_\alpha(v)$$

$$\frac{s_1^2}{s_2^2}\frac{1}{f_{\alpha/2}(v_1,v_2)}<\frac{\sigma_1^2}{\sigma_2^2}<\frac{s_1^2}{s_2^2}f_{\alpha/2}(v_2,v_1)$$

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

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

$$T=\frac{\bar{x}-\mu}{s/\sqrt{n}}\sim T_\alpha(v=n-1)$$

$$\chi^2=\frac{(n-1)s^2}{\sigma^2}\sim\chi^2_\alpha(v=n-1)$$

$$F=\frac{s_1^2}{s_2^2}\sim F_\alpha(v_1=n_1-1,v_2=n_2-1)$$

$$S_p^2=\frac{(n_1-1)s_1^2+(n_2-1)s_2^2}{n_1+n_2-2}$$

$$v=\frac{(s_1^2/n_1+s_2^2/n_2)^2}{\dfrac{(s_1^2/n_1)^2}{n_1-1}+\dfrac{(s_2^2/n_2)^2}{n_2-1}}$$

$$v=n_1+n_2-2$$

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