Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2019/2020

COURSE NAME	:	STATISTICS II
COURSE CODE	:	DAS 20703
PROGRAMME	:	DAU
EXAMINATION DATE	:	DECEMBER 2019 / JANUARY 2020
DURATION	:	3 HOURS
INSTRUCTIONS	:	ANSWER **ALL** QUESTIONS IN SECTION A AND **TWO (2)** QUESTIONS IN SECTION B

THIS QUESTION PAPER CONSISTS OF **NINE (9)** PAGES

SECTION A

Q1 (a) Many cardiac patients wear implanted pacemakers to control their heartbeat. A plastic connector module mounts on the top of the pacemaker. Assuming a standard deviation of 0.0015 and an approximate normal distribution, find a 95% and 99% confidence interval for the mean of all connector modules made by a certain manufacturing company. A random sample of 75 modules has an average of 0.310 inch.

(13 marks)

(b) A study was conducted to determine if a certain metal treatment has any effect on the amount of metal removed in a pickling operation. A random sample of 100 pieces was immersed in a bath for 24 hours without the treatment, yielding an average of 12.2 mm of metal removed and a sample standard deviation of 1.1 mm. A second sample of 200 pieces was exposed to the treatment followed by the 24-hour immersion in the bath, resulting in an average removal of 9.1 mm. Compute a 98% confidence interval estimate for the difference between the population means.

(12 marks)

Q2 (a) It is claimed that an automobile is driven on the average more than 20,000 km per year. To test this claim, a random sample of 100 automobile owners are asked to keep a record of the kilometers they travel. Would you agree with this claim if the random sample showed an average of 23,500 km and a standard deviation of 3900 km? Test the hypothesis at 1% level of significance.

(8 marks)

(b) Based on problem in **Q2(a)**, is the claim is true if there is only have 9 automobile owners as a sample but the average and standard deviation are same. Test the hypothesis at 1% level of significance.

(7 marks)

(c) The mean lifetime of 40 power banks produced by Company Labu is 65 hours and the mean lifetime of 55 power banks produced by Company Labi is 60 hours. If the standard deviation of all power banks produced by Company Labu is 3.5 hours and the standard deviation of all power banks produced Company Labi is 4 hours, test at 5% significance level that the mean lifetime of power banks produced by Company Labu is better than the mean lifetime of Company Labi. Assume the data was taken from a normal distribution.

(10 marks)

SECTION B

Q3 (a) A person takes part in a medical trial that test the effect of a medicine on a disease. Half the people are given medicine and the other half are given a sugar pill, which has no effect on the disease. The medicine has a 60% chance of curing someone. But, people who do not get the medicine still have a 10% chance of getting well. There are 50 people in the trial and they all have the disease. Jarjeet takes part in the trial, but we do not know whether he got the medicine or the sugar pill.

(i) Draw a tree diagram of all the possible cases.

(5 marks)

(ii) Find the probability that Jarjeet gets cured.

(3 marks)

(iii) If Jarjeet get the sugar pill, find the probability that Jarjeet will cured.

(3 marks)

(iv) Calculate the percentages of Jarjeet will do not getting well.

(4 marks)

(b) The two-way contingency **Table 1** gives the breakdown of the population of adults in a particular locale according to employment type and level of life insurance:

An adult is selected at random.

(i) Find the probability that the person has a high level of life insurance.

(1 mark)

(ii) Find the probability that the person has a high level of insurance, given that he does not have a professional position.

(3 marks)

(iii) Find the probability of selecting the person has a medium level of life insurance or have a semi-skilled position.

(3 marks)

(iv) Determine whether or not the events "has a high level of life insurance" and "has a professional position" are independent.

(3 marks)

Q4 The queueing time, X minutes of a customer at a till of a supermarket has probability density function

$$f(x) = \begin{cases} \frac{3}{32}x(k-x), & 0 \le x \le k \\ 0, & otherwise \end{cases}$$

(a) Show that the value of k is 4.

(5 marks)

(b) Find the $F(x)$.

(7 marks)

(c) By using $f(x)$, find the probability the queuing time is between 45 seconds and 75 seconds.

(3 marks)

(d) By using $F(x)$, find the probability of queuing time is more than 2 minutes 15 seconds.

(3 marks)

(e) Find $E(X)$ and $Var(X)$.

(7 marks)

Q5 (a) A lawyer commutes daily from his suburban home to his midtown office. The average time for a one-way trip is 24 minutes with a standard deviation of 3.8 minutes. Assume the distribution of trip times to be normally distributed.

(i) Find the probability that a trip will take at least ½ hour.

(3 marks)

(ii) If the office opens at 9.00 am and he leaves his house at 8.45 am daily, find the percentages of the time is he late for work.

(4 marks)

(iii) If he leaves the house at 8.35 am and coffee is served at the office from 8.50 am until 9.00 am, find the probability that he misses coffee.

(3 marks)

(iv) Find the length of time above which we find the slowest 15% of the trips.
(3 marks)

(b) Researchers at George Washington University and the National Institutes of Health claim that approximately 75% of the people believe “tranquilizers work very well to make a person more calm and relaxed”. For the next interview, there are 80 people have been selected.

(i) Find mean and standard deviation.
(5 marks)

(ii) Find the probability at least 50 are of this opinion.
(4 marks)

(iii) Find the probability that at most 56 are of this opinion.
(3 marks)

Q6 (a) The random variable X in **Table 2**, representing the number of cherries in a cherry puff, has the following probability distribution :

(i) Find the mean μ and the variance σ^2 of X.
(5 marks)

(ii) Find the mean $\mu_{\bar{X}}$ and the variance ${\sigma^2}_{\bar{X}}$ of the mean $\bar{X}$ for random samples of 36 cherry puffs.
(3 marks)

(iii) Find the probability that the average number of cherries in 36 cherry puffs will be less than 5.5.
(4 marks)

(b) The distribution of heights of a certain breed of terrier dogs has a mean height of 72 cm and a standard deviation of 10 cm, whereas the distribution of heights of a certain breed of poodles has a mean height 28 cm with a standard deviation of 5 cm. Assuming that the sample means can be measured to any degree of accuracy.

(i) Find the probability that the sample mean for a random sample of heights of 64 terriers exceeds the sample mean for a random sample of heights of 100 poodles by at most 44.2 cm.

(9 marks)

(ii) Find the probability that the mean height of a random sample of 100 terriers falls between 70.5 cm and 72.5 cm.

(4 marks)

– END OF QUESTIONS –

FINAL EXAMINATION

SEMESTER / SESSION : SEM I / 2019/2020 PROGRAMME CODE : DAU

COURSE NAME : STATISTICS II COURSE CODE : DAS 20703

Table

Table 1

Employment Type	Level of insurance		
	Low	Medium	High
Unskilled	0.07	0.19	0.00
Semi-skilled	0.04	0.28	0.08
Skilled	0.03	0.18	0.05
Professional	0.01	0.05	0.02

Table 2

x	4	5	6	7
$P(X = x)$	0.2	0.4	0.3	0.1

FINAL EXAMINATION

SEMESTER / SESSION : SEM I / 2019/2020 PROGRAMME CODE : DAU

COURSE NAME : STATISTICS II COURSE CODE : DAS 20703

Formula

$$P(A) = \frac{n(A)}{n(S)}$$

$$F(x) = \sum_{-\infty}^{x} P(X = x) \quad , \quad F(x) = \int_{-\infty}^{x} f(x)\, dx$$

$$E(X) = \sum_{x=-\infty}^{\infty} x\, P(X = x) \, , \, E(X) = \int_{-\infty}^{\infty} x\, f(x)\, dx \, , \, Var\,(X) = E(X^2) - [E(X)]^2$$

$$P(X = x) = \binom{n}{x} p^x q^{n-x} \, , \, P(X = x) = \frac{e^{-\lambda}\lambda^x}{x!} \, , \, Z = \frac{X-\mu}{\sigma}, \, Z \sim N(0,1)$$

$$\bar{X} \sim N\left(\mu, \frac{\sigma^2}{n}\right) \, , \, Z = \frac{\bar{X}-\mu}{\sigma/\sqrt{n}} \sim N(0,1)$$

$$\bar{X}_1 - \bar{X}_2 \sim N\left(\mu_1 - \mu_2, \frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}\right)$$

$$\bar{x} - z_{\alpha/2}\frac{\sigma}{\sqrt{n}} \le \mu \le \bar{x} + z_{\alpha/2}\frac{\sigma}{\sqrt{n}} \quad , \quad \bar{x} - z_{\alpha/2}\frac{s}{\sqrt{n}} \le \mu \le \bar{x} + z_{\alpha/2}\frac{s}{\sqrt{n}}$$

$$\bar{x} - t_{\alpha/2,n-1}\frac{s}{\sqrt{n}} \le \mu \le \bar{x} + t_{\alpha/2,n-1}\frac{s}{\sqrt{n}}$$

$$(\bar{x}_1 - \bar{x}_2) - z_{\alpha/2}\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}} \le \mu_1 - \mu_2 \le (\bar{x}_1 - \bar{x}_2) + z_{\alpha/2}\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}$$

$$(\bar{x}_1 - \bar{x}_2) - z_{\alpha/2}\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}} \le \mu_1 - \mu_2 \le (\bar{x}_1 - \bar{x}_2) + z_{\alpha/2}\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$$

$$(\bar{x}_1 - \bar{x}_2) - t_{\alpha/2,\,n_1+n_2-2}\; s_p\sqrt{\frac{1}{n_1} + \frac{1}{n_2}} \le \mu_1 - \mu_2 \le (\bar{x}_1 - \bar{x}_2) + t_{\alpha/2,\,n_1+n_2-2}\; s_p\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$$

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

FINAL EXAMINATION

SEMESTER / SESSION : SEM I / 2019/2020 PROGRAMME CODE : DAU

COURSE NAME : STATISTICS II COURSE CODE : DAS 20703

$$(\bar{x}_1-\bar{x}_2)-t_{\alpha/2,v}\sqrt{\frac{s_1^2}{n_1}+\frac{s_2^2}{n_2}}\le \mu_1-\mu_2\le(\bar{x}_1-\bar{x}_2)+t_{\alpha/2,v}\sqrt{\frac{s_1^2}{n_1}+\frac{s_2^2}{n_2}}$$

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

$$Z_{test}=\frac{\bar{X}-\mu}{\sigma/\sqrt{n}}\quad,\quad Z_{test}=\frac{\bar{X}-\mu}{s/\sqrt{n}}\quad,\quad t_{test}=\frac{\bar{X}-\mu}{s/\sqrt{n}}$$

$$z_{test}=\frac{(\bar{x}_1-\bar{x}_2)-(\mu_1-\mu_2)}{\sqrt{\frac{\sigma_1^2}{n_1}+\frac{\sigma_2^2}{n_2}}}$$

$$z_{test}=\frac{(\bar{x}_1-\bar{x}_2)-(\mu_1-\mu_2)}{\sqrt{\frac{s_1^2}{n_1}+\frac{s_2^2}{n_2}}}$$