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Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
(TAKE HOME)
SEMESTER II
SESSION 2019/2020

COURSE NAME	:	STATISTICS FOR REAL ESTATE MANAGEMENT
COURSE CODE	:	BPE 15102
PROGRAMME CODE	:	BPD
EXAMINATION DATE	:	JULY 2020
DURATION	:	24 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS **OPEN BOOK EXAMINATION**

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

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Q1 A large manufacturing company producing air-conditioner compressor believes the number of units of air-conditioner sold is related to atmospheric temperature. A Research and development officer conducted a study and gathered the data as in **Table Q1**.

Table Q1: The temperature and sale of air-conditioner.

Temperature, ( )	Sale, (in thousand units)
20	50
36	67
40	80
45	75
48	90
55	134
62	108
59	104
87	192
77	150
68	145
80	170
78	155
46	99
79	170
90	173
106	260
120	259
127	255
125	205

(a) Sketch a scatter plot for the data in **Table Q1.**

(4 marks)

(b) Find the estimated regression line by using the least square method. Interpret the result.

(9 marks)

(c) Estimate the sale when the temperature is 152 .

(2 marks)

(d) Compute the coefficient of correlation, r and coefficient of determination, . Interpret these results.

(5 marks)

Q2 (a) A shopkeeper mixes a large portion of red sweets with green sweets in the ratio of three red sweets to one green sweets.

Find the probability that a packet of 6 sweets contains 4 or more red sweets.

(5 marks)

(b) The average running time of disks produced by Company A is 88.1 minutes and a standard deviation of 6.1 minutes, while Company B has a mean running time of 99.3 minutes with a standard deviation of 13.6 minutes.

Find the probability that a random sample of 41 disks from Company B will have a mean running time that at most 15 minutes more than the mean running time of a random sample of 32 disks from Company A.

(8 marks)

(c) Ten sample bottles of the product are selected at random and the foam heights observed are as follows (in millimetres)

210	215	194	195	211	201	198	204	208	196

Construct a 95% confidence interval for the population mean.

(7 marks)

(d) Two types of batteries are tested for their length of life and the length of battery life observed are as follows:

Battery A:

490	491	508	505	509	495
489	511	490	510	513	489

Battery B:

552	569	548	549	548
551	572	568	571	572

Test at 5% significance level that there are significant difference in the two batteries. Assume that the variances of population are unknown but equal.

(10 marks)

- END OF QUESTIONS

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Special Probability Distributions

Binomial:

$P(X = x) = {}^{n}C_{x}.p^{x}.q^{n-x}$ Mean, $\mu = np$ Variance, $\sigma^2 = npq$

Poisson:

$$P(X = x) = \frac{e^{-\mu}\mu^{x}}{x!}$$

Normal:

$$P(X > k) = P\left(Z > \frac{k-\mu}{\sigma}\right)$$

Sampling Distribution

Z – value for single mean:

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

Probability related to single Mean:

$$P(\bar{x} > r) = P\left(Z > \frac{r-\mu}{\sigma/\sqrt{n}}\right)$$

Let,

$$\mu_{\bar{x}_1-\bar{x}_2} = \mu_1 - \mu_2 \quad and \quad \sigma_{\bar{x}_1-\bar{x}_2} = \sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}$$

Z – value for Two Mean:

$$Z = \frac{(\bar{x}_1 - \bar{x}_2) - \mu_{\bar{x}_1-\bar{x}_2}}{\sigma_{\bar{x}_1-\bar{x}_2}}$$

Probability related to two Mean:

$$P(\bar{x}_1 - \bar{x}_2 > r) = P\left(Z > \frac{r - \mu_{\bar{x}_1-\bar{x}_2}}{\sigma_{\bar{x}_1-\bar{x}_2}}\right)$$

Estimation

Variance,

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Confidence interval for single mean:

Large sample: $n > 30$ $\Rightarrow$ σ is known: $\left(\bar{x} - z_{\alpha/2}\left(\sigma / \sqrt{n}\right) < \mu < \bar{x} + z_{\alpha/2}\left(\sigma / \sqrt{n}\right)\right)$

$\Rightarrow$ σ is unknown: $\left(\bar{x} - z_{\alpha/2}\left(s / \sqrt{n}\right) < \mu < \bar{x} + z_{\alpha/2}\left(s / \sqrt{n}\right)\right)$

Small sample: $n < 30$ $\Rightarrow$ σ is unknown: $\left(\bar{x} - t_{\alpha/2}\left(s / \sqrt{n}\right) < \mu < \bar{x} + t_{\alpha/2}\left(s / \sqrt{n}\right)\right)$

Hypothesis Testing

Testing of hypothesis on a difference between two means

Variances	*Samples size*	*Statistical test*
Unknown (Equal)	$n_1, n_2 < 30$	
Unknown (Not equal)	$n_1 - n_2 < 30$	$T_{Test} = \dfrac{\left(\bar{x}_1 - \bar{x}_2\right) - \left(\mu_1 - \mu_2\right)}{\sqrt{\dfrac{1}{n}\left(s_1^2 + s_2^2\right)}}$ $v = 2(n-1)$
Unknown (Not equal)	$n_1, n_2 < 30$	$T_{Test} = \dfrac{\left(\bar{x}_1 - \bar{x}_2\right) - \left(\mu_1 - \mu_2\right)}{\sqrt{\dfrac{s_1^2}{n_1} + \dfrac{s_2^2}{n_2}}}$ $v = \dfrac{\left(\dfrac{s_1^2}{n_1} + \dfrac{s_2^2}{n_2}\right)^2}{\dfrac{\left(\dfrac{s_1^2}{n_1}\right)^2}{n_1 - 1} + \dfrac{\left(\dfrac{s_2^2}{n_2}\right)^2}{n_2 - 1}}$

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Simple Linear Regressions

Let

$$S_{xy} = \sum_{i=1}^{n} x_i y_i - \frac{1}{n}\left(\sum_{i=1}^{n} x_i\right)\left(\sum_{i=1}^{n} y_i\right), \qquad S_{xx} = \sum_{i=1}^{n} x_i^2 - \frac{1}{n}\left(\sum_{i=1}^{n} x_i\right)^2 \quad \text{and}$$

$$S_{yy} = \sum_{i=1}^{n} y_i^2 - \frac{1}{n}\left(\sum_{i=1}^{n} y_i\right)^2$$

Simple linear regression model

$$\hat{y} = \hat{\beta}_0 + \hat{\beta}_1 x$$

where

$$\hat{\beta}_1 = \frac{S_{xy}}{S_{xx}}$$

$$\hat{\beta}_0 = \bar{y} - \hat{\beta}_1 \bar{x}$$

Coefficient of Determination

$$r^2 = \frac{\left(S_{xy}\right)^2}{S_{xx} \cdot S_{yy}}$$

Coefficient of Pearson Correlation

$$r = \frac{S_{xy}}{\sqrt{S_{xx} \cdot S_{yy}}}$$

Analysis of Variance

Mean square for treatment (between)

$$MS_B = \frac{\sum n_i \left(\bar{x}_i - \bar{x}_{GM}\right)^2}{k-1}$$

Mean square for error (within)

$$MS_W = \frac{\sum (n_i - 1) s_i^2}{N-k}$$

F test value

$$F = \frac{MS_B}{MS_W}$$