

Marking Scheme



2021/2022 SEMESTER 2 – TEST

Course : Academic Support & Enrichment Programme

Module : ITS103 – Complementary Business Statistics 1

Date: 30 Nov 2021

Name : _____ Admin No : _____

Module Group: : ITS103 - 01 / 02 / 03 /
04

INSTRUCTION:

- Answer all the questions
 - Write your answer in the space provided in this script
 - Submit this script at the end of test
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Question 1 (20 marks)

1(a) Consider the following set of sample data:

6, 8, 14, 4, 3, 5, 11, 12, 5, 10, 11, 5, 11, 12, 5, 18

Calculate the:

- (i) mean (3 marks)
- (ii) median (3 marks)
- (iii) mode (3 marks)
- (iv) interquartile range (3 marks)

1(b) For the following probability distribution of a random variable,

| | | | | | |
|------------|------|------|------|------|------|
| k | 0 | 1 | 2 | 3 | 4 |
| $P(X = k)$ | 0.54 | 0.16 | 0.06 | 0.04 | 0.20 |

Calculate the

- (i) mean (4 marks)
- (ii) standard deviation (correct to 3 significant figures) (4 marks)

Answers:

1(a) Arrange the numbers in ascending order:

3, 4, 5, 5, 5, 5, 6, 8, 10, 11, 11, 11, 12, 12, 14, 18

(i) mean

$$\bar{x} = \frac{\sum x}{n} = \frac{140}{16} = 8.75$$

(ii) median = $(8 + 10)/2 = 9$

(iii) mode = 5

(iv) interquartile range

$$Q1 = \text{median of } \{3, 4, 5, 5, 5, 5, 6, 8\} = 5 + 5/2 = 5$$

$$Q3 = \text{median of } \{10, 11, 11, 11, 12, 12, 14, 18\} = (11 + 12)/2 = 11.5$$

$$\text{Interquartile range (IQR)} = Q3 - Q1 = 11.5 - 5 = 6.5$$

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1(b)

(i) Mean

$$\begin{aligned}\mu &= \sum k.P(X = k) \\ &= 0(0.54) + 1(0.16) + 2(0.06) + 3(0.04) + 4(0.20) = 1.2\end{aligned}$$

(ii) Standard Deviation

$$\begin{aligned}\text{Variance, } \sigma^2 &= \sum k^2.P(X = k) - \mu^2 \\ &= 0^2(0.54) + 1^2(0.16) + 2^2(0.06) + 3^2(0.04) + 4^2(0.20) - 1.2^2 \\ &= 2.52\end{aligned}$$

$$\text{Standard deviation, } \sigma = \sqrt{\text{Variance}} = \sqrt{2.52} \approx 1.59$$

Question 2 (20 marks)

2(a) A cyclist in Singapore owns many bicycles, including road bike, mountain bike, folding bike, TT bike and other bikes. The probability that a cyclist owns a road bike is 0.55, that it owns a mountain bike is 0.25 and that it owns both a road and a mountain bike is 0.15. What is the probability that a randomly selected cyclist owns a road or a mountain bike?

(5 marks)

$$P(\text{road or mountain}) = P(\text{road}) + P(\text{mountain}) - P(\text{road and mountain}) = 0.55 + 0.25 - 0.15 = 0.65$$

2(b) In how many ways can 3 students be selected from a class of 12 students to form a committee?

(5 marks)

$${}_{12}C_3 = 220$$

2(c) Find the number of 3-digit PIN codes that can be formed where repetition of digits is not allowed.

(5 marks)

$${}_{10}P_3 = 720$$

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2(d) Campus canteen serve meal consists of an appetizer, a main dish and two desserts. Given 4 appetizers, 8 main dishes and 6 desserts, how many different meals are possible?

(5 marks)

$${}_4C_1 \times {}_8C_1 \times {}_6C_2 = 480$$

Question 3 (20 marks)

100 people were randomly selected and they were asked whether they are right-handed or left-handed. The following table shows the result of the survey:

| | Male | Female |
|--------------|------|--------|
| Left-handed | 6 | 5 |
| Right-handed | 46 | 43 |

A person is selected at random from the sample. Find the probability (correct to 2 decimal places) that he/she is

3(a) right-handed female

(5 marks)

3(b) right-handed given the person is a male

(5 marks)

Answer:

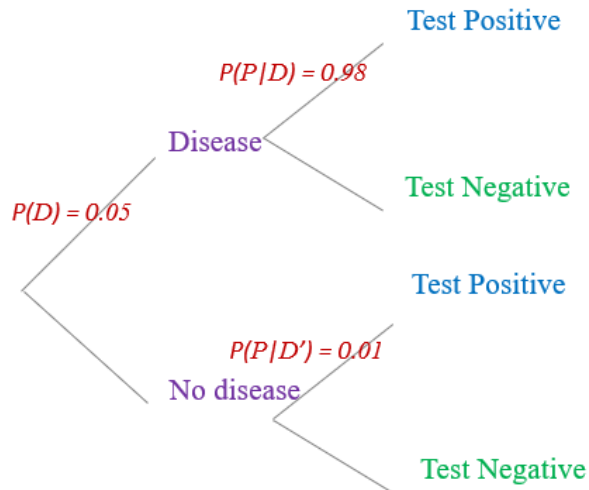
| | Male | Female | Total |
|--------------|------|--------|-------|
| Left-handed | 6 | 5 | 11 |
| Right-handed | 46 | 43 | 89 |
| Total | 52 | 48 | 100 |

(a) $P(\text{Right-handed female}) = 43/100 = 0.43$

(b) $P(\text{Right-handed given that the person is a male}) = 46/52 = 0.88$

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5% of the population is being infected with a disease. Suppose that everyone takes a test regardless if they have this disease, which can produce either a positive or negative test result. A test will be positive 98% of the time if the person has the disease and 1% of the time if the person does not have the disease, as depicted in the given tree diagram.



- 3(c) Find the probability of an individual is tested negative. Give your answers in 4 decimal places.

(5 marks)

P(an individual is tested negative)

$$= (0.05 \times 0.02) + (0.95 \times 0.99) = 0.001 + 0.9405 = 0.9415$$

- 3(d) How many words can be formed by rearranging the letters of the word HAPPY such that the "A" must occupy the first position.

(5 marks)

$$\frac{4!}{2!} = 12$$

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Question 4 (20 marks)

The probability that a cyclist is a road bike cyclist is 0.3 and a random sample of 10 cyclists are selected. It follows a **Binomial distribution** $X \sim B(10, 0.3)$.

(a) What is the mean?

(5 marks)

$$\text{Mean, } \mu = np = (10)(0.3) = 3$$

(b) What is the variance?

(5 marks)

$$\text{Variance, } \sigma^2 = np(1 - p) = (10)(0.3)(0.7) = 2.1$$

(c) What is the probability that 2 cyclists are road bike cyclists? Give your answer in 2 decimal places.

(5 marks)

$$P(X=2) = {}^{10}C_2(0.3)^2(0.7)^8 = 0.23$$

(d) What is the probability that at least 2 cyclists are road bike cyclists? Give your answer in 2 decimal places.

$$\begin{aligned} P(X \geq 2) &= 1 - P(X < 2) \\ &= 1 - P(X=0) - P(X=1) \\ &= 1 - {}^{10}C_0(0.3)^0(0.7)^{10} - {}^{10}C_1(0.3)^1(0.7)^9 \\ &= 0.85 \end{aligned}$$

(5 marks)

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Question 5 (20 marks)

The number of times a cyclist goes for a weekly ride follows a **Poisson distribution** $X \sim P_0(2)$. That is, a cyclist goes for a ride 2 times per week on average.

(a) What is the mean?

(5 marks)

Mean, $\mu = 2$

(b) What is the variance?

(5 marks)

Variance, $\sigma^2 = \mu = 2$

(c) Find the probability that a randomly selected cyclist goes for only 1 ride per week. Give your answer in 2 decimal places.

(5 marks)

$$P(X = 1) = e^{-2} \frac{(2)^1}{1!} = \mathbf{0.27}$$

(d) Find the probability that a randomly selected cyclist goes for 1 ride in a period of 2 weeks. Give your answer in 2 decimal places.

(5 marks)

Average no. of ride in a week = 2

Average no. of ride in 2 weeks = 4

$$P(X = 1) = e^{-4} \frac{(4)^1}{1!} = \mathbf{0.07}$$

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END OF PAPER