BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULTY OF COMMERECE

DEPARTMENT OF ECONOMICS

PROGRAMME: BSc HONORS IN ECONOMICS

NOV 2024

STATISTICS FOR ECONOMICS 1 EC 103 (3)

DURATION: 3 HOURS   TOTAL MARKS: 100

INSTRUCTIONS TO CANDIDATES

(i)   Answer all questions.

(ii)   Each question carries **25 marks.**

(iii)   Start each answer on a new page.

(iv)   No cell phones are allowed into the examination room.

Question one

The daily electricity consumption in kilowatt hours (kWh) by a sample of 20 households in Zimbabwe is recorded in Table 1.1

Table 1.1 Daily household electricity consumption (kWh)

58	50	33	51	38	43	60	55	46	43
51	47	40	37	43	48	61	55	44	35

Using the above figures, calculate:

(i) Range variance   [3 marks]

(ii) Standard deviation   [4 marks]

(iii) Coefficient of variation and comment on the results   [4 marks]

b) Explain four advantages and disadvantages of arithmetic mean. [8 marks]

c) Differentiate between primary and secondary data as they are used in statistics. [6 marks]

Question two

One hundred and seventy (170) companies from the ZSE were randomly selected and classified by sector and size. Table 1.2 shows the cross-tabulation table of joint frequencies for the two categorical random variables 'sector' and 'company size'.

Table 1.2 Cross-tabulation table - ZSE companies by sector and size

Sector	Company size			Row Total
	Small	Medium	Large	
Mining	3	8	30	41
Financial	9	21	42	72
Services	10	6	8	24
Retail	14	13	6	33
Column total	36	48	86	170

(a) What is the probability that a randomly selected ZSE company will be small and operate in the service sector? [3 marks]

(ii) What is the probability that a randomly selected ZSE company will be either a small company or a service sector company, or both? [3 marks]

(iii) What is the probability of a randomly selected ZSE company being both a small and a medium-sized company? [2 marks]

(iv) What is the probability of selecting a small, medium or large ZSE company from the sample of 170 companies surveyed? [2 marks]

b) A factory has three machines and eight possible machine operators.

(i) How many distinct orderings of machine operators to machines are possible? [3 marks]

(ii) What is the probability of one particular ordering of machine operators to the three machines? [3 marks]

(c) A company produces fruit juice in 10 different flavors. A local supermarket sells the product, but has only sufficient shelf space to display three of the company's 10 fruit juice flavors at a time. **[3 marks]**

(i) How many possible groupings of three flavors can the fruit juice company display on the local supermarket shelf? **[3 marks]**

(ii) What is the probability that a particular combination of three fruit juice flavors will be selected by the juice company for display? **[3 marks]**

Question three

(a) A bike race driver uses make A 50% of the time, make B bikes 30% of the time and make C bikes 20% of the time. Of the 25 races he has entered with make A bikes he has won 5, of 15 races with make B bikes he has won 4 and of 10 races with make C bikes he has won 4.

(i) Draw a probability tree diagram. **[4 marks]**

(ii) What is the probability of winning a race? **[2 marks]**

(iii) P (win/ make A). **[2 marks]**

(b) Two fair dice are thrown and their outcomes are added together. Let X be the possible totals from the two dice.

(i) Draw a probability distribution of the data. **[4 marks]**

ii) Using the probability distribution of the data in part (a) above, find the probability that:

(ii) X lies between 3 and 11. **[3 marks]**

(iii) X is greater than 7. **[2 marks]**

(iv) X is at most 9. **[2 marks]**

c) Calculate the expected value of X. **[2 marks]**

d) Calculate the standard deviation of X. **[2 marks]**

Question Four

A product consists of two components. The product fails when either or both components fail. There is a 5% chance that component 1 will fail and a 10% chance that component 2 will fail. The components can fail independently of each other.

a) Explain any three probability rules that you know *(use relevant examples).* [9 marks]

b) Draw the probability tree diagram showing the above information.   [10 marks]

c) What is the probability that the product will fail (i.e. that either or both components will fail together)?   [6 marks]

FORMULAE

i. Arithmetic Mean for Ungrouped Data $\bar{x} = \dfrac{\sum_{i=1}^{n} x_i}{n}$

ii. <u>Arithmetic Mean for Group data</u> $\bar{x} = \dfrac{\sum_{i=1}^{m} f_i x_i}{n}$

iii. Harmonic Mean $= \dfrac{n}{\sum \frac{1}{xi}}$

iv. Geometric Mean $\sqrt[n]{x1.x2.x3.x4\ldots\ldots xn}$

v. Mode $= L_m + \dfrac{C_m\,(f_m - f_{m-1})}{2f_m - (f_{m-1} + f_{m+1})}$

vi. median $= L_m + \dfrac{C_m\left(\frac{n}{2} - F_{m-1}\right)}{f_m}$

vii. Lower quartile (or first quartile, Q_1) $Q_1 = L_q + \dfrac{C_q\left(\frac{n}{4} - F_{q-1}\right)}{f_q}$

viii. Upper quartile (third quartile, Q_3 or 75th percentile) $Q_3 = L_q + \dfrac{C_q\left(\frac{3n}{4} - F_{q-1}\right)}{f_q}$

ix. Variance Ungrouped data $\quad s^2 = \dfrac{1}{n-1}\sum_{1=1}^{n}(x_1 - \bar{x})^2$

x. Variance Grouped data $\quad s^2 = \dfrac{1}{n-1}\sum_{i=1}^{k} f_i(x_i - \bar{x})^2$

xi. Standard Deviation $= \sqrt{S_x^2} = \sqrt{\dfrac{\sum_{i=1}^{k} f_i(x_i - \bar{x})2}{n-1}}$

xii. Coefficient of Variation $\quad CV = \dfrac{S_x}{\bar{X}} \times 100\%$

xiii. Pearson's Coefficient of Skewness $SK_p = \dfrac{3\,(mean - median)}{standard deviation}$ or $SK_p = \dfrac{(mean - mode)}{standard deviation}$

xiv. Bowley's Coefficient of Skewness $SK_b = \dfrac{(Q_3 - Q_2) - (Q_2 - Q_1)}{(Q_3 - Q_1)}$

xv. Conditional Probability $P(A/B) = \dfrac{P(A \cap B)}{P(B)}$

xvi. Binomial Probability $nCrp^x\,q^{n-x}$ or $P(x) = \dfrac{n!}{x!(n-x)!}p^x q^{n-x}$

xvii. $E(x) = \sum x.pi$ Std Dev $\sum(x.pi)^2 - (E(x))^2$

  Mean $(\mu) = np$ and Standard deviation $(\sigma) = \sqrt{npq}$

xviii. Poisson $P(x) = \dfrac{e^{-a} a^x}{x!}$ $P(X = x) = \dfrac{e^{-\lambda} \lambda^x}{\chi!}$,

Mean $(\mu) = $ λ and Standard deviation $(\sigma) = \sqrt{\lambda}$