University of Kelaniya – Sri Lanka

Centre for Distance and Continuing Education

Faculty of Commerce and Management Studies

Bachelor of Business Management (General) Degree Second Year Examination (External) – 2024

June – 2026

BMGT E2045 – Statistics for Management

No. of Questions: Eight (08) Time: 03 hours

Answer any five (05) Questions.

Each question carries 20 marks

Question No.01

a) "Statistics has become an essential tool for managerial decision-making." Discuss with examples.

(10 marks)

b) Differentiate between qualitative and quantitative data, and explain the measurement scales applicable to each.

(10 marks)

(Total 20 marks)

Question No.02

a) A university library plans to conduct a survey among students to evaluate library utilization. The survey will gather information on:

- Frequency of library visits
- Preferred study area
- Number of books borrowed per semester
- Student academic year

Based on above information you are required to answer the following questions

i). Describe the population.

ii). Define the sampling frame.

iii). Suggest an appropriate sampling method and justify your answer.

iv). Develop four categorical questions for the survey.

v). Develop four numerical questions for the survey.

(04*05 = Total 20 marks)

Question No.03

The following grouped frequency distribution shows the monthly expenditure on groceries of 150 households in a town.

Monthly Expenditure (Rs. '000)	Number of Households
20 and less than 30	10
30 and less than 40	35
40 and less than 50	60
50 and less than 60	30
60 and less than 70	15

Using above information, answer the following questions.

i). Calculate the mean monthly expenditure of households and explain what the result indicates about the spending behavior of households in the town.

ii). Determine the modal class and estimate the mode of the monthly expenditure distribution. Interpret the result in the context of household spending.

iii). Calculate the standard deviation of monthly expenditure and comment on the variability of expenditure among households.

iv). Calculate the coefficient of variation (CV) for the monthly expenditure data and assess whether household expenditure is relatively consistent or highly dispersed.

(05*04 = Total 20 marks)

Question No.04

a) Discuss the role of probability in business decision making with suitable examples.

(05 marks)

b) Explain the difference between, mutually exclusive events and Independent events with examples.

(05 marks)

c) Explain the concept of conditional probability.

(05 marks)

d) A company employing 250 workers conducted an evaluation of its employee training program. The following information was obtained:

150 workers attended the training program.
90 workers received high performance ratings.
60 workers both attended the training program and received high performance ratings.

Based on the above information:
Calculate the probability that a worker received a high-performance rating, given that the worker attended the training program and interpret the calculated probability.

(05 marks)

(Total 20 marks)

Question No.05

a) A researcher wishes to model the number of customers who purchase a product after viewing an advertisement. He prefers to apply binomial distribution for this.
Explain the conditions that must be satisfied before the binomial distribution can be used.

(05 marks)

b) A quality control manager finds that 8% of products manufactured in a factory are defective. A random sample of 12 products is selected by him. Then, find the probability that at least one product is defective?

(05 marks)

c) The time required to complete an online transaction follows a normal distribution with a mean of 4 minutes and a standard deviation of 0.8 minutes.

i. Find the probability that a transaction takes between 3 and 4.5 minutes.

(05 marks)

ii. Determine the time below which 90% of transactions are completed.

(05 marks)

(Total 20 marks)

Question No.06

a) Suppose, a researcher is constructing a confidence interval for a population mean. You are Required answer following questions,

i). Explain the purpose of a confidence interval in statistical analysis.

(03 marks)

ii). Explain how the confidence level affects the range of a confidence interval.

(03 marks)

iii). State two assumptions required when constructing a confidence interval for a population mean when the population standard deviation is known.

(04 marks)

b) A hospital administrator wants to estimate the proportion of patients who are satisfied with the quality of service provided.

A random sample of 250 patients is selected, and 185 indicate that they are satisfied.

i). Calculate a 95% confidence interval for the population proportion of satisfied patients.

(03 marks)

ii). Interpret the confidence interval of above part (i).

(03 marks)

iii). Explain why confidence intervals are often preferred over point estimates when making managerial decisions.

(04 marks)

(Total 20 marks)

Question No.07

A marketing analyst is studying how advertising cost and product price influence the weekly sales of bottled juice sold by company ABC. Advertising cost, price, and sales are measured in rupees. Data were collected from a sample of 50 retail outlets over a one-month period. You are provided with the following regression output. You are required to answer the questions based on this output.

Table 1 - Regression Statistics

Multiple R	0.952318
R Square	0.906904
Adjusted R Square	0.903112
Standard Error	5.102341
Observations	50

Table 2- ANOVA

	Df	**SS**	**MS**	**F**	**Significance F**
Regression	2	2980.450	1490.225	72.614	0.000021
Residual	47	964.550	20.523		
Total	49	3945.000			

Table 3- Coefficients

Variable	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	18.56021	45.21789	0.410	0.683	-72.430	109.550
Advertising Budget (Rs)	65.43210	3.214567	2.037	0.047	0.785	12.540
Price (Rs per unit)	-8.76543	0.298754	-1.908	0.062	-0.412	0.230

i). Interpret the Regression Statistics table (Table 1)

(05 marks)

ii). Interpret the ANOVA table (Table 2)

(05 marks)

iii). Interpret the Coefficient table (Table 3)

(10 marks)

(Total 20 marks)

Question No.08

a) A mobile network company claims that 75% of its customers are satisfied with its service. To verify this claim, an independent researcher conducts a survey using a random sample of 200 customers. The results show that 142 customers are satisfied with the service. Answer the following questions to test company's claim at a 5% significance level.

i). State the null and alternative hypotheses.

ii). State the appropriate test statistic. Show full working by writing the correct formula and substituting the given values.

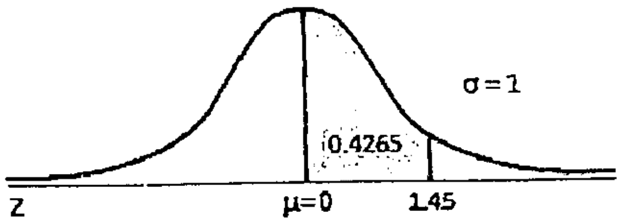
iii). Find the critical value and rejection region for the hypothesis test. Draw an appropriate diagram and show your working clearly.

iv). State the result of the hypothesis test.

v). Write a conclusion in the context of the problem, clearly interpreting the result.

(04*05 = Total 20 marks)

This table provides the area between the mean and some Z score.
For example, when Z score = 1.45 the area = 0.4265.



Z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0753
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2517	0.2549
0.7	0.2580	0.2611	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.2910	0.2939	0.2967	0.2995	0.3023	0.3051	0.3078	0.3106	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.8	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.4980	0.4981
2.9	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3.0	0.4987	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990	0.4990
3.1	0.4990	0.4991	0.4991	0.4991	0.4992	0.4992	0.4992	0.4992	0.4993	0.4993
3.2	0.4993	0.4993	0.4994	0.4994	0.4994	0.4994	0.4994	0.4995	0.4995	0.4995
3.3	0.4995	0.4995	0.4995	0.4996	0.4996	0.4996	0.4996	0.4996	0.4996	0.4997
3.4	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4998
3.5	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998
3.6	0.4998	0.4998	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.7	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.8	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.9	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000

FORMULAE

Summary Measures

Sample Mean

$$\bar{x} = \frac{x_1 + x_2 + \cdots + x_n}{n} = \frac{\sum x_i}{n}$$

Sample Standard Deviation

$$s = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n-1}} = \sqrt{\frac{\sum x_i^2 - n\bar{x}^2}{n-1}}$$

Probability Rules

- **Complement rule**

  $P(A^C) = 1 - P(A)$

- **Addition rule**

  General: $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$

  For independent events:

  $P(A \text{ or } B) = P(A) + P(B) - P(A)P(B)$

  For mutually exclusive events: $P(A \text{ or } B) = P(A) + P(B)$

- **Multiplication rule**

  General: $P(A \text{ and } B) = P(A)P(B \mid A)$

  For independent events: $P(A \text{ and } B) = P(A)P(B)$

  For mutually exclusive events: $P(A \text{ and } B) = 0$

- **Conditional Probability**

  General: $P(A \mid B) = \dfrac{P(A \text{ and } B)}{P(B)}$

  For independent events: $P(A \mid B) = P(A)$

  For mutually exclusive events: $P(A \mid B) = 0$

Discrete Random Variables

Mean

$$E(X) = \mu = \sum x_i p_i = x_1 p_1 + x_2 p_2 + \cdots + x_k p_k$$

Standard Deviation

$$s.d.(X) = \sigma = \sqrt{\sum (x_i - \mu)^2 p_i} = \sqrt{\sum \left(x_i^2 p_i\right) - \mu^2}$$

Binomial Random Variables

$$P(X = k) = \binom{n}{k} p^k (1-p)^{n-k}$$

where $\dbinom{n}{k} = \dfrac{n!}{k!(n-k)!}$

Mean

$$E(X) = \mu_X = np$$

Standard Deviation

$$s.d.(X) = \sigma_X = \sqrt{np(1-p)}$$

Normal Random Variables

- $z\text{-score} = \dfrac{\text{observation} - \text{mean}}{\text{standard deviation}} = \dfrac{x - \mu}{\sigma}$
- Percentile: $x = z\sigma + \mu$
- If X has the $N(\mu, \sigma)$ distribution, then the variable

  $Z = \dfrac{X - \mu}{\sigma}$ has the $N(0,1)$ distribution.

Normal Approximation to the Binomial Distribution

If X has the $B(n, p)$ distribution and the sample size n is large enough (namely $np \geq 10$ and $n(1-p) \geq 10$), then X is approximately $N\left(np, \sqrt{np(1-p)}\right)$.

Sample Proportions

$$\hat{p} = \frac{x}{n}$$

Mean

$$E(\hat{p}) = \mu_{\hat{p}} = p$$

Standard Deviation

$$s.d.(\hat{p}) = \sigma_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}}$$

Sampling Distribution of $\hat{p}$

If the sample size n is large enough (namely, $np \geq 10$ and $n(1-p) \geq 10$)

then $\hat{p}$ is *approximately* $N\left(p, \sqrt{\dfrac{p(1-p)}{n}}\right)$.

Sample Means

Mean

$$E(\bar{X}) = \mu_{\bar{X}} = \mu$$

Standard Deviation

$$s.d.(\bar{X}) = \sigma_{\bar{X}} = \frac{\sigma}{\sqrt{n}}$$

Sampling Distribution of $\bar{X}$

If X has the $N(\mu, \sigma)$ distribution, then $\bar{X}$ is

$$N(\mu_{\bar{X}}, \sigma_{\bar{X}}) \Leftrightarrow N\left(\mu, \frac{\sigma}{\sqrt{n}}\right).$$

If X follows *any* distribution with mean μ and standard deviation σ and n is large,

then $\bar{X}$ is *approximately* $N\left(\mu, \dfrac{\sigma}{\sqrt{n}}\right)$.

This last result is **Central Limit Theorem**