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22STP315BN

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

MSc DEGREE EXAMINATION DECEMBER 2025
(Third Semester)

Branch - **STATISTICS**

MAJOR ELECTIVE COURSE – I : BIOSTATISTICS AND EPIDEMIOLOGY

Time: Three Hours Maximum: 75 Marks

SECTION-A (10 Marks)

Answer **ALL** questions

ALL questions carry **EQUAL** marks (10 × 1 = 10)

Module No.	Question No.	Question	K Level	CO
1	1	Select the sampling method ensures that every individual in the population has an equal chance of being selected? a) Cluster sampling b) Systematic sampling c) Random sampling d) Stratified sampling	K1	CO1
	2	Show, 8 out of 20 patients are above 60 years old. If one patient is selected at random, the probability that the patient is above 60 is: a) 0.2 b) 0.3 c) 0.4 d) 0.5	K2	CO1
2	3	Match McNemar's test is used for: a) Comparing means of two independent groups b) Comparing paired categorical data c) Comparing variances of two samples d) Testing normality of a distribution	K1	CO2
	4	Compare mean weight of patients in 3 different diet plans. Which test is appropriate? a) Paired t-test b) Chi-square test c) ANOVA d) Z-test for two means	K2	CO2
3	5	Which type of correlation is appropriate when both variables are continuous and normally distributed? a) Spearman's rank correlation b) Pearson's correlation c) Point-biserial correlation d) Kendall's tau	K1	CO3
	6	Relate, Survival analysis is primarily used to analyse: a) Continuous outcomes like blood pressure b) Time-to-event data, like time until relapse c) Categorical data like blood groups d) Proportions of patients	K2	CO3
4	7	How Randomization in a clinical trial is used ? a) Increase sample size b) Eliminate selection bias and balance confounders c) Ensure statistical significance d) Measure relative risk	K1	CO4
	8	Demonstrate the Relative risk: a) Probability of outcome in exposed group ÷ Probability of outcome in unexposed group b) Odds of outcome in exposed group ÷ Odds of outcome in unexposed group c) Risk difference between exposed and unexposed groups d) Probability of no event	K2	CO4
5	9	Choose a test measures: a) Ability to detect all true positive cases b) Ability to detect all true negative cases c) Probability of disease in the population d) Predictive value of a positive test	K1	CO5
	10	Classify the ROC curve helps clinicians to: a) Decide the optimal cut-off value for a diagnostic test b) Measure disease prevalence c) Calculate relative risk d) Compare means between two groups	K2	CO5

SECTION - B (35 Marks)

Answer **ALL** questions

ALL questions carry **EQUAL** Marks (5 × 7 = 35)

Module No.	Question No.	Question	K Level	CO
1	11.a.	Experiment with biostatistics and its scope in clinical research.	K3	CO1
		(OR)		
	11.b.	Solve the range and standard deviation for given patient dataset. Blood sugar levels: 90, 100, 110, 120, 130.		

Cont...

<table>
<tr><td rowspan="3">2</td><td>12.a.</td><td>Distinguish between paired t-test and unpaired t-test with clinical examples.</td><td rowspan="3">K4</td><td rowspan="3">CO2</td></tr>
<tr><td colspan="2">(OR)</td></tr>
<tr><td>12.b.</td><td>Compare the mean systolic blood pressure between two treatment groups. Write the formula for calculating the sample size for comparing two means.</td></tr>
<tr><td rowspan="3">3</td><td>13.a.</td><td>Analyze the correlation coefficient (r) between height and weight. The heights (cm) and weights (kg) of 5 patients are:
<table><tr><td>Height</td><td>160</td><td>165</td><td>170</td><td>175</td><td>180</td></tr><tr><td>Weight</td><td>55</td><td>60</td><td>65</td><td>70</td><td>75</td></tr></table></td><td rowspan="3">K4</td><td rowspan="3">CO3</td></tr>
<tr><td colspan="2">(OR)</td></tr>
<tr><td>13.b.</td><td>Analyze and fit a simple linear regression line (Y = a + bX). The number of cigarettes smoked per day (X) and systolic BP (Y) in 6 patients:
<table><tr><td>X</td><td>2</td><td>4</td><td>6</td><td>8</td><td>10</td><td>12</td></tr><tr><td>Y</td><td>120</td><td>125</td><td>130</td><td>135</td><td>140</td><td>145</td></tr></table></td></tr>
<tr><td rowspan="3">4</td><td>14.a.</td><td>Explain the purpose of randomization in clinical trials.</td><td rowspan="3">K5</td><td rowspan="3">CO4</td></tr>
<tr><td colspan="2">(OR)</td></tr>
<tr><td>14.b.</td><td>Explain Absolute Risk Reduction (ARR) and Risk Ratio (RRR) with an example.</td></tr>
<tr><td rowspan="3">5</td><td>15.a.</td><td>Compare the Positive Predictive Value (PPV) and Negative Predictive Value (NPV)? Give clinical examples.</td><td rowspan="3">K5</td><td rowspan="3">CO5</td></tr>
<tr><td colspan="2">(OR)</td></tr>
<tr><td>15.b.</td><td>Mention the Rule on ROC curve, How is it used to evaluate a diagnostic test?</td></tr>
</table>

SECTION -C (30 Marks)

Answer **ANY THREE** questions

ALL questions carry **EQUAL** Marks (3 × 10 = 30)

<table>
<tr><th>Module No.</th><th>Question No.</th><th>Question</th><th>K Level</th><th>CO</th></tr>
<tr><td>1</td><td>16</td><td>Apply mean, median and mode for the following systolic blood pressure.
<table><tr><td>Systolic BP (mmHg)</td><td>110–120</td><td>120–130</td><td>130–140</td><td>140–150</td><td>150–160</td></tr><tr><td>Number of Patients (f)</td><td>5</td><td>10</td><td>15</td><td>12</td><td>8</td></tr></table></td><td>K3</td><td>CO1</td></tr>
<tr><td>2</td><td>17</td><td>Analyze a new diagnostic test, 40 patients were tested before and after training the technician. The results are shown:
<table><tr><td></td><td>After Positive</td><td>After Negative</td></tr><tr><td>Before Positive</td><td>20</td><td>10</td></tr><tr><td>Before Negative</td><td>5</td><td>15</td></tr></table>Use Mc Nemar's test to check if there is a significant change after training.</td><td>K4</td><td>CO2</td></tr>
<tr><td>3</td><td>18</td><td>Assume a survival study follows 50 patients after cardiac surgery. Draw a Kaplan–Meier survival curve and explain how to calculate the median survival time.</td><td>K4</td><td>CO3</td></tr>
<tr><td>4</td><td>19</td><td>Assess a cohort study reports to the following data:
<table><tr><td>Group</td><td>Disease (+)</td><td>Disease (–)</td><td>Total</td></tr><tr><td>Exposed</td><td>30</td><td>170</td><td>200</td></tr><tr><td>Unexposed</td><td>10</td><td>190</td><td>200</td></tr></table>Calculate Relative Risk (RR), Odds Ratio (OR), Absolute Risk Reduction (ARR), and Risk Ratio (RRR). Interpret the results.</td><td>K5</td><td>CO4</td></tr>
<tr><td>5</td><td>20</td><td>Explain the relationship between sensitivity, specificity, and predictive values, and how disease prevalence affects predictive values.</td><td>K5</td><td>CO5</td></tr>
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Z-Z-Z END