



Continuous Assessment Test (CAT) - II - October 2024

Programme	B. Tech.	Semester	Fall 2024-25
Course Code & Course Title	BMAT202L (Probability and Statistics)	Slot	E1+TE1
Faculty	Dr.Amit Kumar Rahul Dr.B.Jaganathan Dr.S.Devi Yamini Dr.Sethukumarasamy K Dr.Manimaran J Dr.Dhivya M	Class Number	CH2024250102209 CH2024250102210 CH2024250102211 CH2024250102212 CH2024250102213 CH2024250102214
Duration	90 Minutes	Max. Mark	50

General Instructions:

- Write only your registration number on the question paper in the box provided and do not write other information.
- Only non-programmable calculator without storage and statistical table are permitted.

Answer all questions.

Q. No	Sub Sec.	Description	Marks																																	
1.		<p>Ten students Weight (W), Height (H) and their Age (A) are given below. Find the regression equation of Weight on Height and Age.</p> <table><tr><td>W (kg)</td><td>55</td><td>51</td><td>46</td><td>49</td><td>63</td><td>56</td><td>59</td><td>62</td><td>56</td><td>67</td></tr><tr><td>H (cm)</td><td>142</td><td>144</td><td>135</td><td>143</td><td>173</td><td>165</td><td>170</td><td>147</td><td>174</td><td>167</td></tr><tr><td>Age</td><td>15</td><td>14</td><td>13</td><td>15</td><td>20</td><td>21</td><td>19</td><td>23</td><td>24</td><td>28</td></tr></table> <p>Hence, estimate W when H=164 and Age=25.</p>	W (kg)	55	51	46	49	63	56	59	62	56	67	H (cm)	142	144	135	143	173	165	170	147	174	167	Age	15	14	13	15	20	21	19	23	24	28	10
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2.	(a)	<p>For the given data,</p> $r_{12} = 0.8, \quad r_{13} = -0.4, \quad r_{23} = -0.55$ <p>Compute the partial correlation coefficient $r_{12.3}$ and multiple correlation coefficient $R_{1.23}$.</p>	5																																	
	(b)	<p>A machine learning model is used to classify email messages as spam or not spam. During testing, the model was evaluated on 200 email messages, and it classified 120 of them as spam. The expected proportion of spam emails is known to be 50%. Is the model biased toward classifying emails as spam? Perform a hypothesis test at a 5% level of significance.</p>	5																																	
3.	(a)	<p>A manufacturer of balloons produces 40 percent that are oval and 60 percent that are round. Packets of 10 balloons may be assumed to contain random samples of balloons. Determine the probability that such a packet contains:</p> <p>(i) An equal number of oval balloons and round balloons.</p> <p>(ii) Fewer oval balloons than round balloons.</p>	2+3																																	
	(b)	<p>The duration of telephone conversations in a booth follows an exponential distribution, with an average length of 5 minutes. Find the probability that a randomly selected call from this booth:</p> <p>(i) Lasts less than 5 minutes. (2 marks)</p> <p>(ii) Lasts more than 4 minutes if it is known that the call already lasted for 2 minutes.</p>	2+3																																	
4.	(a)	<p>If the life of a welding machine is a random variable following a Weibull distribution having a probability density function $f(x) = 0.035 (0.6)x^{-0.4} e^{-0.035x^{0.6}}$, $x > 0$, then (i) what is the expected lifetime for the welding machine? (ii) find the probability that the welding machine will still be in operating condition after 5000 hours?</p>	2+3																																	

	(b)	<p>The monthly earnings of a group of people are normally distributed, with a mean of Rs. 1750 and a standard deviation of Rs. 50.</p> <p>(i) Calculate the percentage of people whose income falls between Rs. 1668 and Rs. 1832.</p> <p>(ii) Determine the percentage of people whose income exceeds Rs. 1832.</p>	2.5+2.5
5.	(a)	<p>A random sample of 100 electronic devices produced by a company had an average lifespan of 71.8 hours. Assuming a population standard deviation of 8.9 hours, does this suggest that the mean lifespan of the devices is greater than the target lifespan of 70 hours? Use a 0.05 level of significance. Also find 95% confidence limit.</p>	6
	(b)	<p>A Cyber security firm is asked to evaluate the security of a company's network to check for vulnerabilities.</p> <p>(i) What type of error would the firm commit if it erroneously rejects the null hypothesis that the network is secure?</p> <p>(ii) What type of error would the firm commit if it erroneously accepts the null hypothesis that the network is secure?</p> <p>What would the likely impact of these errors be?</p>	4