BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: IMSC **SEMESTER : III**
BRANCH: CQEDS **SESSION : MO/2024**

SUBJECT: ED211 LINEAR STATISTICAL MODELS AND REGRESSION ANALYSIS

TIME: 3 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Calculator is allowed during the examination.
6. F-table will be provided during the examination.

			CO	BL
Q.1	Derive the **sampling distribution** of the intercept and the slope of a simple linear regression.	[10]	1	2
Q.2	A researcher wants to test the effects of **diet type** (Vegan, Keto, and Mediterranean) and **exercise level** (Low and High) on weight loss. The study measures weight loss in kilograms after 12 weeks for individuals in each combination of diet and exercise level. The weight loss values are presented in the table below:	[10]	2	4

Diet/Exercise	Low Exercise	High Exercise
Vegan	2.1, 2.3, 2.2	4.1, 4.3, 4.2
Keto	3.0, 2.8, 2.9	5.2, 5.1, 5.0
Mediterranean	1.9, 2.0, 2.1	4.0, 3.9, 4.1

Using appropriate statistical technique and at 5% level of significance, answer the following:
(i) Does the type of diet (Vegan, Keto, Mediterranean) significantly affect weight loss?
(ii) Does the level of exercise (Low, High) significantly affect weight loss?
(iii) Is there an interaction between diet type and exercise level that influences weight loss?

Q.3 A company wants to predict the **monthly sales revenue** (Y) based on two factors: **Advertising budget** (X1) in thousands of dollars, and **Number of staff** (X2) employed at the store. [10] 3 4

The dataset for 3 stores is provided below:

Store	X1 (Advertising Budget)	X2 (Number of Staff)	Y (Monthly Sales Revenue)
1	15	5	50
2	20	7	70
3	25	6	65

(i) Write the general form of the multiple linear regression equation. [2]
(ii) Using the matrix method, calculate the coefficients (β0, β1, and β2) for the regression equation. Show all steps. [6]
(iii) Interpret the coefficients β1, and β2. [2]

PTO

Q.4 For a regression analysis, the following plots are obtained: [10] 4 4

Figure-1

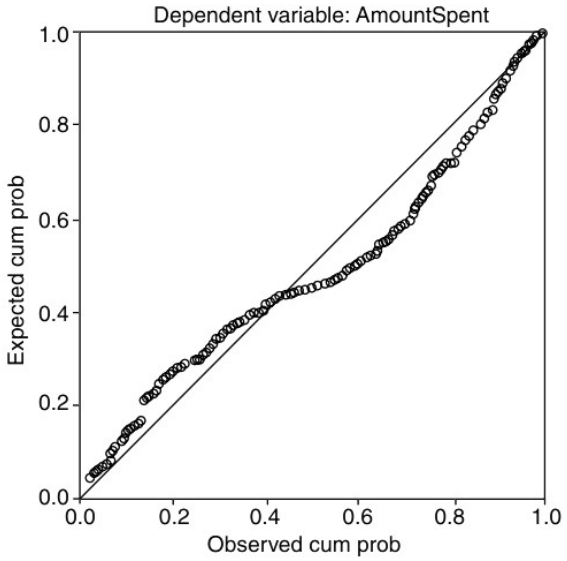
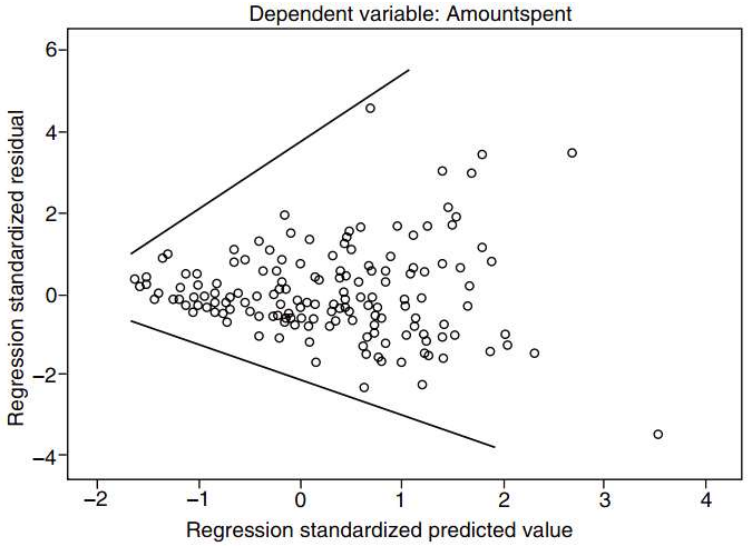


Figure-2



(i) What is the name of the plot shown in figure-1? Which assumption of regression analysis can be tested from this plot? What do you infer from this plot?
(ii) From figure-2, which assumption of regression analysis can be tested? What do you infer from this plot?

Q.5 Give the functional form of binary logistic regression. Discuss the following logistic regression model diagnostics elaborately: [10] 5 2
(i) Omnibus Test (Likelihood ratio test)
(ii) Wald's test

:::::26/11/2024 E:::::