



INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR
Mid-Spring Semester Examination 2023-2024

Date of Examination: _____ **Session (FN/AN):** _____

Duration: 2 hrs

Full marks: 30

Subject No.: IM60208

Subject: Generalized Linear Models and Applications

Department/Center/School: Department of Industrial & Systems Engineering

Specific charts, graph paper, log book etc., required: NIL.

Special Instructions (if any):

1. Answer all questions.
2. Assume any missing values, clearly stating the assumption.
3. If your answer is not legible, it shall be treated as incorrect.
4. If the answer is written without the correct question number, it shall be treated as incorrect.

Q.1) Show that the Normal distribution is part of the Exponential family?

Total: 5 pts

Q.2) A study is conducted to understand if a college degree is essential for being rich. The researcher who is conducting this study collects the data by asking a random 50 respondents from the top 10% richest people in the world whether they are university graduates or not. We call such category of people as “rich”. Their survey revealed that among the “rich” respondents only 40% had a college degree. The researcher also asked this question to 50 respondents who were not “rich”. It was found that 30% of these respondents were not college educated. Based on this information, answer the following questions.

- | | |
|---|---------|
| (a) What is the sampling design adopted in this study? | 2 marks |
| (b) Find a point estimate for the proportion of college educated people who are rich? | 4 marks |
| (c) Check if there is any association between College education and being “rich”? | 4 marks |
| (d) Test the claim that one is ten percent more likely to be “rich” if he/she does not attend college? | 4 marks |
| (e) Based on odds ratio, test the claim that your odds of being rich does not change based on your college education? | 4 marks |

Total: 18 pts

Q.3) Derive an expression for the Maximum Likelihood Estimate of category proportions in a multinomial distribution?

Total: 5 pts

Q.4) Based on the following data in the table 1.

Torque (kNm)	3	12	6	20	14
Mileage (mpg)	55	40	55	10	15

Table 1: Data for question 4

- (a) Check if torque and mileage are associated. 4 marks
(b) Find the 95% confidence interval for mileage for a car with average torque? 3 marks

Total: 7 pts