BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI
SECOND SEMESTER 2020-2021
ECON F241 ECONOMETRIC METHODS

QUIZ 1 - 24 FEB 2021

TOTAL MARKS: 10 **Name:** **ID:**

Q1. Consider the following model. Are they linear regression models? If not, can they be converted into linear models by manipulating the variables involved? Convert those which can be. **(20% weightage of total marks of this quiz)**

a) $\mathrm{GRADE_i} = \frac{1}{\beta_0+\beta_1 \mathrm{TVTIME_i}}$

b) $\mathrm{GRADE_i} = \frac{\mathrm{TVTIME_i}}{\beta_0+\beta_1 \mathrm{TVTIME_i}}$

c) $\mathrm{GRADE_i} = \frac{1}{1+\exp(-\beta_0-\beta_1 \mathrm{TVTIME_i})}$

Q2. A few colleges have called their students back to campus. UGC wants to calculate the money spent by colleges to ensure proper sanitation and medical facilities so as to help other colleges that have not opened campuses yet to plan their finances. Therefore, they have come up with the following model:
(40% weightage of marks)

$$\widehat{\mathrm{MONEYSPENT}_i} = b_1 + b_2 \widehat{\mathrm{CAMPUSSTUDS}_i}$$

$$\mathrm{E[MONEYSPENT]} = 10.374, \mathrm{E[CAMPUSSTUDS]} = 2.687$$
$$\mathrm{Var}(CAMPUSSTUDS) = 0.898, \quad \mathrm{Var}(MONEYSPENT) = 1.554, \quad \mathrm{Cov}(MONEYSPENT, CAMPUSSTUDS) = 1.178$$

where *MONEYSPENT* is the money spent by the college in '000Rs. and *CAMPUSSTUDS* is the number of students in the college in '000.

a) **Calculate b_1 and b_2**. Interpret these coefficients and comment on their sign and magnitude in terms of the number of students on campus and the money spent by the college in rupees.
b) BITS Pilani wants to know if this model is useful. What should they calculate? Calculate that **and tell how much variation in the money spent by the college can be attributed to the variation in the number of students.**
c) Calculate **the F statistic** and perform an appropriate F test given the 454 colleges were used for the development of this model.
d) The Chief Warden has decided to open the campus for and final year undergrad students. He expects only **626 students to come**. How much money will be required for proper sanitation and medical facilities according to the aforementioned model?

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Q3. β_{XY} and β_{YX} represent the slopes when Y is regressed on X and X is regressed on Y respectively. Answer the following questions: **(20% weightage of marks)**

a) Using these two coefficients alone how will you figure out the correlation between X and Y.

b) If the product of β_{XY} and β_{YX} is 1, does it matter if we regress X on Y or Y on X? Explain carefully.

Q.4. Answer the following: **(20% weightage of marks)**

a) r_1 = coefficient of correlation between 111 pairs of values $\mathbf{(X_i, Y_i)}$ where Y_i is weight in kilograms and X_i is monthly ANC bill in Rs. Let r_2 = coefficient of correlation between 111 pairs of valued $\boldsymbol{(aX_i + b, cY_i + d)}$ where a, b, c, d are 0.34, 076. 9.87 and 2.54 respectively. Express r_2 in terms of r_1.

b) If r_1 is positive, tell whether the following statements are **true or false:**

i) r between (-Xi, -Yi) is also positive.

ii) *r* between $(-Xi, Yi)$ and that between $(Xi, -Yi)$ can be either positive or negative.

iii) Both the slope coefficients β_{XY} and β_{YX} are positive, where β_{YX} = slope coefficient in the regression of *Y* on *X* and β_{XY} = slope coefficient in the regression of *X* on *Y*.