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DAFFODIL INTERNATIONAL UNIVERSITY

Batch 44 Section F

Time: 45 Minutes Full Marks: 15

Question: Simple Linear Regression

A Software Engineering department conducted a practical assessment to investigate the relationship between students' weekly independent debugging practice hours and their practical debugging assessment scores.

Ten students were selected, and the following observations were recorded. The department intends to use the observed relationship to estimate assessment performance and evaluate how well a linear regression model represents the collected data.

Student	A	B	C	D	E	F	G	H	I	J
Practice Hours (X)	8	3	11	5	12	7	4	10	6	9
Assessment Score (Y)	72	48	76	53	88	61	55	81	68	69

Answer the following questions using the given observations.

1. Construct a suitable calculation table and determine $\sum X$, $\sum Y$, $\sum X^2$, and $\sum XY$. (2)

2. Using the appropriate regression formulas, calculate the slope (b_1) and intercept (b_0), and hence obtain the estimated regression equation. Interpret the slope in the context of the given situation. Also, explain whether the intercept has a meaningful practical interpretation. (4)

3. The department wants to estimate the practical assessment score of a student who practises debugging for 14 hours per week. Use the estimated regression equation to obtain the predicted score. Based on the observed data, comment on whether this prediction should be treated with caution. (2)

4. Evaluate the goodness of fit of the estimated regression model by calculating:

   (a) Total Sum of Squares (TSS);

   (b) Explained Sum of Squares (ESS);

   (c) Residual Sum of Squares (RSS);

   (d) Coefficient of Determination (R^2).

   Finally, interpret the obtained coefficient of determination in the context of the problem. (4)

5. Using the calculated coefficient of determination (R^2), determine Karl Pearson's correlation coefficient (r). Show how you determine its sign and interpret the direction and strength of the linear relationship. (2)

6. For the student who practised for 6 hours, calculate the residual. State whether the fitted regression model over-predicted or under-predicted that student's actual score. (1)

— End of Question Paper —