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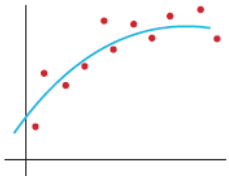
Final (DS-660)
Due on 02/21/2023 @ 8:30 PM (45 points)

A. Fill in the blanks: **(10 Points)**

1. _____ are the unknown values that the model seeks to determine.
2. _____ is the measure of the fit of the line to the data.
3. The phrase "at least" can be translated as _____ in Business Analytics.
4. Transform the following statement into mathematical form _____
   "The amount of money spent on research and development projects cannot exceed the assigned budget of $300,000."
5. _____ involves selecting items from a population so that every subset of a given size has an equal chance of being selected.
6. _____ is the probability of occurrence of one event given that another event has already occurred.
7. The following graph shows _____ relationship.



8. The complement of H_a is _____.
9. A sample is a subset of _____.
10. Decision variables that we force to be integers are called _____.

B. Theoretical questions: **(14 Points)**

1. What do you understand by linear optimization?
2. Name the different types of constraints.
3. Explain what you understand by Monte Carlo Simulation. (Please DO NOT write what the book says please try to use your own words)
4. What is an optimal solution point in a linear optimization model?
5. State the four steps to develop any linear optimization model.
6. Explain Delphi Method in short; also illustrate the concept with a real time example.
7. Explain Simple Linear Regression in detail. The result of simple linear regression in excel provides us R square value, can you advise what is the significance of this value.

C. Numericals **(21 Points)**

1. For the data in the Excel file Gasoline Prices do the following:
   Develop spreadsheet models for forecasting prices using simple moving average and simple exponential smoothing. Compare your results to the outputs from Excel's Data Analysis tools.

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2. The Excel file Beverage Sales lists a sample of weekday sales at a convenience store, along with the daily high temperature. Compute the covariance and correlation between temperature and sales.

3. The managing director of a consulting group has the following monthly data on total overhead costs and professional labor hours to bill to clients:

Overhead Costs	Billable Hours
$365,000	3,000
$400,000	4,000
$430,000	5,000
$477,000	6,000
$560,000	7,000
$587,000	8,000

   a. Develop a trendline to identify the relationship between billable hours and overhead costs.
   b. Interpret the coefficients of your regression model. Specifically, what does the fixed component of the model mean to the consulting firm?
   c. If a special job requiring 1,000 billable hours that would contribute a margin of $38,000 before overhead was available, would the job be attractive?

4. Using PivotTables, compute the mean and standard deviation for each metric by year in the Excel file Freshman College Data. Are any differences apparent from year to year?

5. The nationwide political poll in a particular country indicates that the probability for the candidate to be a republican is 0.55, a communist is 0.30, and a supporter of the patriots of that country is 0.15. Assuming that these probabilities are accurate, within a randomly chosen group of 10 citizens:
   a. What is the probability that four are communists?
   b. What is the probability that none are republican?

6. Construct frequency distributions and histograms for the numerical data in the Excel file Cell Phone Survey. Also, compute the relative frequencies and cumulative relative frequencies.

7. A firm is considering the purchase of a new technology that is expected to produce an annual net saving in labor costs of $8000 in each of the six years. The initial cost is $30000, and annual maintenance cost is $1000. The company can access the required fund at the current market interest rate of 14% per annum compounded annually. By calculating NPV of the proposed expenditure, decide whether the technology should be purchased.