

**K. J. SOMAIYA INSTITUTE OF MANAGEMENT STUDIES AND RESEARCH,**  
**Vidyavihar, Mumbai- 400077**  
**Program: PGDM (FS) (Batch 2016-18) Trim-IV**  
**Subject: Quantitative Models in Finance**  
**(End Term Examination) (In computer lab)**

**Maximum Marks: 50**

**Date : 21<sup>st</sup> Sep, 2017**

**Duration: 3 hours**

**Instructions**

- **Write all your answers in the answer sheet clearly. Your submission in answer sheet will be primarily used for evaluation, supported by the excel submission.**
- **Use Excel and solver as required and keep saving your work (one single file with reference of your program and roll no) as you proceed. Follow the instructions of data centre personnel and transfer your folder to an appropriate place in the server.**
- **If you assume any data not given, please provide suitable explanation of the same.**

**Part A – Problems (Answer any 3 out of 5: 3X11=33 marks)**

1. Julie James is opening a lemonade stand. She believes the fixed cost per week of running the stand is \$50.00. Her best guess is that she can sell 300 cups per week at \$0.50 per cup. The variable cost of producing a cup of lemonade is \$0.20.
  - a. Given her other assumptions, what level of sales volume will enable Julie to break even?
  - b. Given her other assumptions, discuss how a change in sales volume affects profit.
  - c. Given her other assumptions, discuss how a change in sales volume and variable cost jointly affect profit.
  
2. A bank is attempting to determine where its assets should be invested during the current year. At present, \$500,000 is available for investment in bonds, home loans, auto loans, and personal loans. The annual rates of return on each type of investment are known to be the following: bonds, 10%; home loans, 16%; auto loans, 13%; personal loans, 20%. To ensure that the bank's portfolio is not too risky, the bank's investment manager has placed the following three restrictions on the bank's portfolio:
  - The amount invested in personal loans cannot exceed the amount invested in bonds.
  - The amount invested in home loans cannot exceed the amount invested in auto loans.
  - No more than 25% of the total amount invested can be in personal loans.

The bank wants to maximize the annual return on its investment portfolio.

- a. Formulate the problem (identifying decision variables, constraints and objective function) with a suitable optimization model.
- b. Solve in Excel.
- c. Use Solver Table to analyse the effects of increasing the budget to \$700000 in increments of

\$50000.

3. State University wants to purchase 1100 computers from three vendors. Vendor 1 charges \$500 per computer plus a total delivery charge of \$5000. Vendor 2 charges \$350 per computer plus a total delivery charge of \$4000. Vendor 3 charges \$250 per computer plus a total delivery charge of \$6000, vendor 1 will sell the university at most 500 computers, vendor 2, at most 900, and vendor 3, at most 400. The minimum order from any vendor is 200 computers. Determine how to minimize the cost of purchasing the needed computers.
  - a. Formulate the problem (identifying decision variables, constraints, and objective function) with a suitable optimization model.
  - b. Solve in Excel.
  
4. Suppose the current exchange rate is 100 yen per dollar. We currently sell 100 units of a product for 700 yen. The cost of producing and shipping the product to Japan is \$5, and the current elasticity of demand is -3. Assume the demand function is linear. Determine the optimal price to charge.
  - a. Formulate the problem (identifying decision variables, constraints, and objective function) with a suitable optimization model.
  - b. Solve in Excel.
  - c. Use Solver Table and analyse the effects of different exchange rates: 60 yen/\$, 80 yen/\$, 100 yen/\$, 120 yen/\$, 140 yen/\$, and 160 yen/\$.
  
5. Perlman & Brothers, an investment company, intends to invest a given amount of money in three stocks. From past data, the means and standard deviations of annual returns have been estimated and provided in the table below, along with correlations among the annual returns on the stocks.

stock	mean	Standard Deviation	Combination	Correlation
1	0.14	0.20	Stocks 1 and 2	0.6
2	0.11	0.15	Stocks 1 and 3	0.4
3	0.10	0.08	Stocks 2 and 3	0.7

- a. Explain the use of matrix multiplication in the calculation of portfolio variance.
- b. Help the company to find a minimum-variance portfolio that yields an expected annual return of at least 0.13.
- c. Modify the model in (b) and then run Solver to find the portfolio that achieves at least a 0.13 expected return and minimizes the probability of a negative return.

**Part B - Case Analysis (Answer anyone of two: 1X17 = 17 marks)**

6. Howie's Bakery is one of the most popular bakeries in town, and the favourite at Howie's is

French bread. Each day of the week, Howie's bakes a number of loaves of French bread, more or less according to a daily schedule. To maintain its fine reputation, Howie's gives to charity any loaves not sold on the day they are baked. Although this occurs frequently, it is also common for Howie's to run out of French bread on any given day-more demand than supply. In this case, no extra loaves are baked that day, the customers have to go elsewhere (or come back to Howie's the next day) for their French bread. Although French bread at Howie's is always popular, Howie's stimulates demand by running occasional 10% off sales.

Howie's has collected data for 20 consecutive weeks, 140 days in all. These data are provided in the **data file**. The variables are Day (Monday-Sunday), Supply (number of loaves baked that day), OnSale (whether French bread is on sale that day), and Demand (loaves actually sold that day).

- a. Howie's wants to see whether regression can be used successfully to estimate Demand from the other data in the file. Howie's reasons that if these other variables can be used to predict Demand, then he might be able to determine his daily supply (number of loaves to bake) in a more cost-effective way.
  - b. How successful is regression with these data? Is Howie correct that regression can help him determine his daily supply?
  - c. Is any information missing that would be useful? How would you use it? Is this extra information really necessary?
7. The beta of a stock is found by running a regression with the monthly return on a market index as the explanatory variable and the monthly return on the stock as the dependent variable.
- a. Explain why most stocks have a positive beta.
  - b. Explain why a stock with a beta with absolute value greater than one is more volatile than the market index and a stock with a beta less than one (in absolute value) is less volatile than the market index.

Relevant data are provided in the **data file** to estimate the beta for each of the four companies listed: Caterpillar, Goodyear, McDonalds, and Ford. Using the S& P as the market index, run the regression analysis.

- c. For each of these companies, what variation in its returns is explained by the variation in market index? What percentage is unexplained?
- d. Verify (using Excel's COVAR and VARP functions) that the beta for each company is given by

.  
Also verify that the correlation between each company's returns and the market's returns is the square root of  $R^2$ .

**Data for Case questions 6 & 7 are given in excel file (data file for PGFS) to be downloaded from server.**

\* \_\_\_\_\_ \*