

K. J. SOMAIYA INSTITUTE OF MANAGEMENT STUDIES AND RESEARCH,

Vidyavihar, Mumbai- 400077

Program: PGFS (Batch 2017-19) Trim-IV

Subject: Quantitative Methods in Finance
(End Term Examination) (In computer lab)

19th Sep, 2018

Maximum Marks: 50

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.
- Access the data file from the location indicated by data center personnel.
- 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. Georgia McBeal is trying to save for her retirement. She believes she can earn 10% on average each year on her retirement fund. Assume that at the beginning of each of the next 40 years, Georgia will allocate x dollars to her retirement fund. If at the beginning of a year Georgia has y dollars in her fund, by the end of the year, it will grow to $1.1y$ dollars.
 - a. How much should Georgia allocate to her retirement fund each year to ensure that she will have \$1 million at the end of 40 years?
 - b. Perform a sensitivity analysis to understand the changes in the allocation based on the earnings rate from 10 % to 15 % in steps of 1 %.
 - c. What key factors are being ignored in this analysis of the amount saved for retirement?
2. Moneyco has \$100,000 to invest at time 1 (the beginning of year 1). The cash flows associated with the five available investments are listed below:

Investment data						
	A	B	C	D	E	
Time 1	-1.00	-1.00	-1.00			
Time 2		1.15			-1.00	
Time 3			1.28	-1.00		
Time 4	1.40			1.15	1.32	

For example, every dollar invested in A in year 1 yields \$1.40 in year 4. In addition to

these investments, Moneyco can invest as much money each year as it wants in CDs, which pay 6% interest. The company wants to maximize its available cash in year 4. Assuming it can put no more than \$50,000 in any investment, develop an LP model to help Moneyco achieve its goal

- a. Formulate the problem as an LP model (inputs, decision variables, objective function and outputs).
 - b. Solve the model and identify the optimal solution.
 - c. Run a SolverTable and discuss the changes in optimal solution if the max amount specified is changed from 50000 to 75000 in steps of 5000.
3. Boris Milkem's firm owns six assets. The expected selling price (in millions of dollars) for each asset is given below:

Data on selling prices of assets (in \$millions)						
	Asset 1	Asset 2	Asset 3	Asset 4	Asset 5	Asset 6
Sold in year 1	15	16	22	10	17	19
Sold in year 2	20	18	30	20	19	25
Sold in year 3	24	21	36	30	22	29

For example, if asset 1 is sold in year 2, the firm receives \$20 million. To maintain a regular cash flow, Milkem must sell at least \$20 million of assets during year 1, at least \$30 million worth during year 2, and at least \$35 million worth during year 3.

- a. Formulate a suitable model for Milkem to maximize his total revenue from assets sold during the next 3 years.
 - b. Use Solver to determine the optimal solution.
 - c. Modify the model to account if one year's excess to be carried forward and adjusted in next year's requirement.
4. Suppose Ford currently sells 250,000 Ford Mustangs annually. The unit cost of a Mustang, including the delivery cost to a dealer, is \$16,000. The current Mustang price is \$20,000, and the current elasticity of demand for the Mustang is -1.5.
- a. Assuming the demand function to be of constant elasticity type, formulate a suitable model to determine a profit-maximizing price for the Mustang.
 - b. Use Solver to determine the optimal solution.
 - c. Suppose Ford makes an average profit of \$800 from servicing a Mustang purchased from a Ford dealer. (This is an average over the lifetime of the car.) How do your answers to part **b** change?
5. I have \$1000 to invest in three stocks. Let R_i be the random variable representing the annual return on \$1 invested in stock i . For example, if $R_i = 0.12$, then \$1 invested in stock i at the beginning of a year is worth \$1.12 at the end of the year. The means are $E(R_1) = 0.14$, $E(R_2) = 0.11$, and $E(R_3) = 0.10$.

The variances are $Var R1 = 0.20$, $Var R2 = 0.08$, and $Var R3 = 0.18$. The correlations are $r12 = 0.8$, $r13 = 0.7$, and $r23 = 0.9$.

- Formulate an NLP model (inputs, decision variables, objective function and outputs) to determine the minimum –variance portfolio that yields an expected annual return of at least 0.12.
- Solve the model with Solver.
- Run a SolverTable to analyse the changes in the solution for changes in the expected portfolio return between 0.10 and 0.15 in steps of 1 %.

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

- Suppose that a regional express delivery service company wants to estimate the cost of shipping a package (Y) as a function of cargo type, where cargo type includes the following possibilities: fragile, semi-fragile, and durable. Costs for 15 randomly chosen packages of approximately the same weight and same distance shipped, but of different cargo types, are provided in the file - **PGFS-QMF Data File- NK**.
 - Formulate an appropriate multiple regression model to predict the cost of shipping a given package.
 - Estimate the formulated model using the given sample data, and interpret the estimated regression coefficients.
 - According to the estimated regression model, which cargo type is the *most* costly to ship? Which cargo type is the *least* costly to ship?
 - How well does the estimated model fit the given sample data? How might the model be improved?
 - Given the estimated regression model, predict the cost of shipping a package with semi-fragile cargo.
- Management of a home appliance store would like to understand the growth pattern of the monthly sales of Blu-ray disc players over the past two years. Managers have recorded the relevant data in the file - **PGFS-QMF Data File- NK**.
 - Create a scatterplot for these data. Comment on the behavior of monthly sales at this store over time.
 - Estimate an appropriate regression equation to explain the variation of monthly sales over given time period. Interpret the estimated regression coefficients.
 - Analyze the estimated equation's residuals. Plot the residuals. Do they suggest that the regression equation is adequate?
 - If not, return to part b and revise the equation until results are satisfactory.

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