



Mathematics and Modeling for Finance, HW 1

Due on October 13, 2006

- 1) A MAJOR LOTTERY ADVERTISES THAT IT PAYS THE WINNER \$10 MILLION. HOWEVER, THIS PRIZE MONEY IS PAID AT THE RATE OF \$500,000 EACH YEAR (WITH THE FIRST PAYMENT BEING IMMEDIATE) FOR A TOTAL OF 20 PAYMENTS. WHAT IS THE PV OF THIS PRIZE AT 10% INTEREST RATE?
- 2) FIND THE PV OF THE FOLLOWING TWO DUE ANNUITIES

$$(-1, 0, 1, 2), (-1, 0, 0, 2, 3)$$

AT THE RATE $r = 10\%$. WHICH OF THEM IS MORE FAVOURABLE? ~~WHAT~~ CAN BE SAID FROM IRR POINT OF VIEW? IF THE FOLLOWING ANNUITY IS SAID TO BE MORE FAVOURABLE THAN THE ABOVE TWO, WHAT IS MINIMAL VALUE OF x ?

$$(-1, 0, 0, 0, x)$$

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- 3) DOWNLOAD HISTORICAL STOCK PRICES FOR AT LEAST 3 COMPANIES FOR THE LAST 10 YEARS. BASED ON ANNUAL INTEREST RATE OF 5%, CALCULATE WHAT IS THE PV OF A PORTFOLIO MADE BY BUYING ONE STOCK OF EACH OF THESE COMPANIES EACH DAY AT THE LOWEST PRICE.
- 4) SHOW GRAPHICALLY TIME DEPENDANCE OF STOCK PRICES OF AT LEAST 3 COMPANIES FOR THE LAST 10 YEARS. SHOW ALSO TIME DEPENDANCE OF THE PV OF THE PORTFOLIO FROM PROBLEM #3 (FOR A GIVEN DATE, PV SHOULD BE CALCULATED FOR THAT DATE, AND SEPARATELY, ON ANOTHER GRAPH, PV CALCULATED FOR TODAY'S DATE SHOULD BE ~~SHOWN~~ SHOWN).
- 5) CALCULATE MEAN VALUES, VARIANCES, DEVIATIONS, AND CORRELATION MATRIX FOR THE ~~PRICES~~ STOCK PRICES DOWNLOADED IN PROBLEM #3. FIND ALSO NEGATIVE SEMI-VARIANCES AND NEGATIVE SEMI-DEVIATIONS.



- 6) FIND RATES OF RETURN FOR EACH OF DATA SETS DOWNLOADED IN PROBLEM #3 DEFINED BY THE TRADE ACTION "BUY TODAY AT THE LOWEST PRICE, SELL TOMORROW AT THE HIGHEST". CALCULATE MEAN, VARIANCE, DEVIATION AND CORRELATION MATRIX FOR THE DATA FOR THREE COMPANIES.
- 7) CALCULATE SKEW AND KURTOSIS FOR STOCK PRICES (SAY, HIGHEST) DISTRIBUTION FOR ONE OF THE COMPANIES USING DATA DOWNLOADED IN PROBLEM #3. GRAPHICALLY SHOW THE DISTRIBUTION OF PRICES USING 100 BINS ON THE APPROPRIATE RANGE. ALSO PLOT THE CORRESPONDING GAUSSIAN DISTRIBUTION USING PARAMETERS FROM PROBLEM #5. COMPARE THE PLOTS.



- 8) CALCULATE ~~SD~~ SKEW AND KURTOSIS FOR INTEREST RATES DISTRIBUTION DEFINED IN PROBLEM #6. GRAPHICALLY SHOW THE DISTRIBUTION OF INTEREST RATES USING 100 BINS ON THE APPROPRIATE RANGE. ALSO PLOT THE CORRESPONDING GAUSSIAN DISTRIBUTION USING PARAMETERS FROM PROBLEM #6. COMPARE THE PLOTS.
- 9) FIND THE VARIANCE AND STANDARD DEVIATION FOR THE ROLL OF THE DICE (SIX-SIDED).
- 10) FIND THE EXPECTED VALUE, THE VARIANCE, AND STANDARD DEVIATION FOR A SUM OF SPOTS OBTAINED IN TWO INDEPENDENT ROLLS OF THE SIX-SIDED DICE