VBA for Finance SMM238   Final Coursework

The mark that you score on this coursework constitutes 100% of the final assessment for this module. There will be no other assignment. The assessment will be based on the level of basic comprehension or understanding that you will demonstrate. We will also be looking for ability to apply the relevant VBA concepts, critical thinking and originality skills**.**

Presentation

All your code, data inputs and outputs should be in the same **workbook**. Each question will marked out of 100 marks. Credit is given for good presentation ie. efficiency, elegance clarity of the code and professional model design. Therefore please remember to choose your data variable names carefully, indent your code, comment extensively to explain your code. When there are multiple ways of doing the same thing, use more efficient commands and richer data structures to achieve the same result.

Submission

Upload your report of not more than 15 pages to the SMM238 moodle website. Also upload the file containing your results and macro on Moodle. Remember to save as macro enabled workbooks. In case your macros get disabled during the submission process, please make sure all members of your group save the same final version of the results in your U-drive or other forms of back up. Where we do not find macros on your Moodle file, we will request any one of the group members to resubmit the coursework.

Submission Deadline   **Friday: 17 July 2020 Time: 2355hrs**

Answer <u>any four</u> questions of your own choice
(Each question carries 100 marks)

Make the necessary assumptions to complete your VBA models in a clear and easy to follow structure. When documenting your models, assume that you are an investment analyst, portfolio manager, bank fund manager etc where you are introducing a new approach to analysing your client's reports by using VBA programming. You want to persuade them to appreciate the advantages of VBA modelling and switch from using excel.

1   Develop and document a subroutine that allows the user to query exchange rates across three or more currencies. Prepare a spreadsheet that stores a table of exchange rates across three currencies that the user can fill in before the program runs.

> For example to illustrate you could use the following rates :

> 1 GBP = 1.12952 EUR   1 EUR = 0.885329 GBP

> 1 GBP = 1.64004 USD   1 USD = 0.609740 GBP

> 1 USD = 0.688735 EUR   1 EUR = 1.45194 USD

> At run time the user simply states the source and destination currencies and your sub should output to the screen the relevant exchange rate picked out from the table. Make assumptions of your choice and create appropriate visual basic loops to demonstrate how such a model can be used in day to day business decisions **100%**

2.   Create and document a model to produce a repayment table for a fixed rate loan using the PMT or iteration or variable rate or any other function to calculate the monthly payment. The loan is to be repaid in equal monthly instalments over its life and the first payment is to be made at the end of the first month. Use dialog boxes, user forms etc to enter the user inputs. The program should validate the user input for reasonableness and ask the user to modify any input that is not appropriate. For output, use the worksheet predesigned with labels, table headings, formatting and so on. Make assumptions of your choice and create appropriate visual basic loops to demonstrate how such a model can be used in day to day business decisions.

Write a short essay discussion to compare and contrast VBA and excel.**(100 marks).**

3.   Develop a model to simulate the price of a stock given its current price, expected return, volatility, and the simulation step size. Make all these input variables so that the user can change them. The user should also be able to generate new price paths easily. Create a graph to show the simulated price path for the stock and its certain and uncertain components. **Make the appropriate assumptions to create a Monte Carlo Style Simulation**   **(100 marks)**

4.   Create and document a model that an investor can use to structure a portfolio using three asset class approach. The user will input the total portfolio size as well as his allocations at the levels of asset class, categories within each asset class and specific mutual funds within each category. The portfolio output should show the amount of money that will be invested in each mutual fund.   **(100 marks)**

5. *(Make assumptions of your own choice to add appropriate features to the models)*
    (a) Create and document a model to calculate the price of a bond given its yield to maturity, face amount, annual coupon rate, frequency of coupon payment, and remaining life. Make all these input variables so that a user can use the model to value any bond for which these data are available. Create a chart to show how the price of a bond grows or declines to par value as it approaches maturity. Add suitable spinners to the annual coupon rate and yield to maturity so that you can study how these variables affect the price of a bond.

    (b) Create and document a model to calculate the duration and modified duration for a bond given the annual coupon rate, yield to maturity, remaining number of coupons, coupon payment frequency, and face value. The model should calculate the duration both from their definitions as well as using the appropriate VBA functions. Also create a chart to show how the modified duration varies with yield to maturity. Attach a spinner to the coupon rate so that the user can also study its effect on duration.

    (c) Create a model to show the dependence of the modified duration of a bond on the bond's remaining life in the form of a chart. Make all of the key bond variables input variables so that the user can specify them.   **(100 marks)**

6. **Choose <u>any three</u> problems and solve** *(Make assumptions to add appropriate features to the model)*

(a) Create and document a function to calculate the implied volatility of an option using the Black-Scholes-Merton (BSM) equations given its price and the other necessary inputs.

(b) Develop a model to calculate the price and the Greek letters for European puts and calls on dividend -paying stocks based on a Black Scholes –Merton (BSM) model.

(c). Develop and document a function to calculate the price for European puts and calls on dividend paying stocks based on the Black-Scholes-Merton (BSM) model.

(d) Develop and document a model to calculate the projected profits of a portfolio of positions in stocks, calls and puts at any time for a range of stock prices. All the positions are on the same stock and all the options expire at the same time. For each position the user should be able to enter the position type (stock, put or call) , exercise price or stock purchase price, position size and premium paid (if option). In addition the user will also provide input values for time to expiration, volatility interest rate and the yield for the stock. Create a chart to show the projected portfolio profits (values) for a range of stock prices. **(100 marks)**

7 Develop and document a model to estimate the price of American options (both puts & calls) on a stock that will pay a known dollar amount of dividend at a known time in the future. Use a 5-step CRR binomial tree for the calculation. Simultaneously calculate the values of the equivalent European options. **(100 marks)**

8 You are currently 40 years old. Starting today, you want to save in 25 growing annual instalments enough money to accumulate $1 million (after all taxes) in today's dollars by the time you retire at age 65. You expect to be able to save every year an amount 2% more than the previous year. You currently have $100,000 saved, and you plan to invest this money and all new savings in a stock fund that is expected to return 8% per year, of which 2% will be dividends and 6% will be capital gains. All the money will be in taxable accounts; you will have to pay income taxes at a 15% rate on the dividend incomes as you earn them at the end of each year. In addition, assume that you will sell all holdings at the time you retire and pay the necessary capital gains taxes at the rate of 15%. Assume inflation rate will average 3% per year over the period. *How much money will you have to save in the*

first year?

Set this up as a model so that a user can input other values (for example, different tax rates) in order to do similar calculations for his own situation. **(100 marks)**

9. Develop and document a VBA model to simulate claims from a variety of different insurance lines and find the probability of ruin of an insurance company based on the capital set aside compared to the amount lost due to claims. Make any additional assumptions of your choice to create a Monte Carlo simulation of ruin to solve the problem

(100 marks)

10. Develop and document a VBA model of Unit Linked Endowment/Non profit endowment assurance where the User decides what initial expenses, interest, sterling and unit rates, number of years, mortalities etc. VBA code will simulate the endowment contract and output it as a table. Make any additional assumptions of your own choice**(100 marks)**

11. Develop and document a classical risk model with sub-exponential claim size distribution. Use a conditional Monte Carlo idea involving the order statistics to simulate the probability of ultimate ruin and demonstrate asymptotic efficiency. **(100 marks)**