UNIVERSITY OF ZIMBABWE
ASSOCIATION OF FINANCIAL ENGINEERS

Department of Mathematics and Computational Sciences
Bachelor of Science Honours Degree in Financial Mathematics.

May 2024 HACKATHON/CODE-FEST .

May 16, 2024

1 Problem Question 1: Level 1

1.1 Application of Ordinary Differential Equations in Finance

A certain college graduate borrows $8000 to buy a car. The lender charges interest rate at an annual rate of 10%. Assuming the interest is compounded continuously and that the borrower makes payments continuously at a constant annual rate k.

1.2

Determine the payment rate k that is required to pay off the loan in three years?

1.3

Determine how much interest is paid during the three year period?

1.4 Programming Languages:

GROUP 1: R programming
GROUP 2: Python programming

END

2 Problem Question 2: Level 2

2.1 Application of statistical computing, statistical inference and regression analysis in Finance

The provided excel sheet contains Reserve Bank Of Zimbabwe(RBZ) interest rates data for three consecutive years. Use the sheet to solve the following problems.

2.2

Using the interest rates information in the provided excel sheet, compute and visualize the pairwise correlation matrix for all the 4 variables?

2.3

Use regression analysis models to visualize the relationship between each variable(independent Variables) against the Lending rates(terget variable) stating clearly the linear regression equations?

2.4

Analyze the variables relationship visualizations you made and explain what would happen to Lending rates if the Policy rates were to increase by 50%?

2.5 Programming Languages:

GROUP 1: R programming
GROUP 2: Python programming

END

3 Problem Question 3: Level 3

3.1 Application of Calculus, Annuities and Financial Mathematics

Susan to save a fixed sum of $400 per month in a savings account which she has just opened at an agreed AER of $2,5\%$. If she makes her first of these equal lodgements today and the last lodgement one month before the 5^{th} anniversary of opening the account.

3.2

Compute a geometric series model that shows the future value of these lodgements?

3.3

Find the value of the fund at the 5^{th} anniversary?

3.4 Programming Languages:

GROUP 1: R programming
GROUP 2: Python programming

Hint: $Future\,Value = Present\,Value(1+r)^n$

END

4 Problem Question 4: Level 4

4.1 Application of Logistic Regression and Credit Risk Models

The provided excel sheet contains simulated data for CLAVIS Bank customers. Use the data on the sheet to calculate the following:

4.2

The Default Score Model stating clearly the intercept and other coefficients for each independent variable as provided in the excel sheet,

4.3

Visualize D on a smooth scatter plot using each of the given variables except gender.

4.4

Analyze the relationship visualizations you made and explain implications of these relationships.

4.5 Programming Languages:

GROUP 1: R programming
GROUP 2: Python programming

END