SAUDER
School of Business

Real Estate Division

BUSI 121 Foundations of Real Estate Mathematics

PURPOSE AND SCOPE

The *Foundations of Real Estate Mathematics* course BUSI 121 is intended to introduce the student to the techniques of mortgage calculations, investment analysis and statistical analysis in a real estate context. The course will provide you with detailed information on statistical techniques, cash flow analysis, discounting, compounding, and the mathematics of real estate finance and investment analysis. There is also a brief overview of graphing and surveying techniques.

After reading the Course Manual and proceeding through the Course Workbook, the student should have a basic understanding of the methods and techniques involved in financial and statistical analysis, as they relate to real estate. Listed below are general objectives for what a student should learn from this course:

- Describe the time value of money and compound interest as the basis of financial analysis.
- Be able to convert equivalent interest rates based on different compounding periods.
- Calculate loan information: present and future values, interest rates, annuity payments, outstanding balances, and amortization periods.
- Explain the impact of bonuses and discounts on the effective interest rate charged on a loan.
- Calculate the market value of a mortgage under various financing terms.
- Calculate yields, net present values and profitability indices in order to be able to compare investments.
- Manipulate linear equations and draw simple line graphs.
- Describe measuring and surveying techniques used in Canada.
- Explain the techniques for arranging and analyzing statistical data.
- Calculate the various measures of central tendency and dispersion in a statistical sample.
- Calculate correlation between two variables and perform linear regression analysis.
- Analyze time series data and identify different types of trends in data.
- Identify the various sampling methods and be able to measure the statistical reliability of a sample.

LESSON 1 – The Basis of Financial Analysis and Interest Rate Conversions

1. Explain the distinction between simple and compound interest.
2. Convert between annual and periodic interest rates.
3. Calculate the future and present value of lump sums.
4. Calculate the yield of an investment, expressed as a given nominal rate.
5. Convert equivalent interest rates using different compounding frequencies.
6. Calculate the future value of an interest-only loan.
7. Calculate the effective annual rate from a given nominal rate.
8. Calculate the interest adjustment payment required for early advancement of a mortgage.

LESSON 2 – Analysis of Financial Flows and Investments

1.   Calculate the present and future value of regular and irregular cash flows.
2.   Calculate the present value of annuities.
3.   Calculate the payment, interest rate, and amortization period of a mortgage.
4.   Discuss the structure of the Canadian mortgage loan.
5.   Describe and calculate the present value of perpetual annuities.
6.   Calculate deferred annuities and annuities due.

LESSON 3 – Future Value Analysis and Outstanding Balances

1.   Perform analysis of cash flows in order to determine the interest rate and holding period required to reach a desired future value sum.
2.   Calculate equivalent payments based on different payment schedules.
3.   Calculate outstanding balances on loans.
4.   Calculate the interest and principal components of a payment or a series of payments.
5.   Calculate the final payment owing on a mortgage.

LESSON 4 – Yields, Bonuses, Discounts, and the Secondary Mortgage Market

1.   Explain the distinction between the primary and secondary mortgage market.
2.   Calculate the market value (or cash-equivalent) price of a vendor take-back mortgage or a loan assumption.
3.   Calculate the yield on fully or partially amortized bonused and discounted mortgages.

LESSON 5 – The Impact of Financing on Property Prices

1.   Calculate the bonus required to achieve a desired rate of interest.
2.   Explain applications of bonuses and discounts.
3.   Describe the impact of prepayment on bonused mortgages.
4.   Calculate the impact of vendor financing arrangements on the market value of a mortgage.
5.   Evaluate the impact of assumable financing on property prices.

LESSON 6 – Real Estate Investment Analysis and Discounting

1.   Discuss the various techniques and terminology used in equity analysis.
2.   Calculate the present value and net present value of investments.
3.   Calculate present value ratios and profitability indices.
4.   Calculate the internal rate of return for an investment.
5.   Explain the implicit reinvestment assumption involved in yield calculations.
6.   Compare different investment alternatives taking into account various reinvestment assumptions and investment time horizons.

LESSON 7 – Mathematics of Graphing and Surveying

1. Manipulate linear equations in order to determine the slope of a line and the intercepts of variables.
2. Draw simple linear graphs.
3. Calculate the area of a given figure and convert measurement units.
4. Identify and describe basic survey systems used in Canada.
5. Determine the shape of a property by following metes and bounds directions.
6. Describe a property using surveying terms.

LESSON 8 – Introduction to Statistics and Simple Data Description

1. Define a "variable" and its properties.
2. Do simple mathematical summations.
3. Calculate and explain the difference between absolute and percentage changes in variables.
4. Arrange data in groups and differentiate the features of grouped and ungrouped data.
5. Determine the absolute and relative frequencies of data.
6. Draw and interpret line graphs and histograms.

LESSON 9 – Univariate Data Descriptive Measures

1. Calculate and explain the differences between various measures of central tendency: the mean, the median, and the mode.
2. Calculate and interpret the various measures of dispersion: the standard deviation, the variance, the coefficient of variation, and the range.

LESSON 10 – Multivariate Data Analysis and Sampling Theory

1. Create graphical representations of the relationship between two variables.
2. Define the term "correlation" and be able to calculate a linear correlation coefficient.
3. Use the graphic method and the "least squares" method to determine a best fit regression equation.
4. Explain how to use a multivariate regression equation to obtain the predicted value of a dependent variable.
5. Identify the different types of data variation that indicate a trend and be able to determine what type of trends are present in a data set.
6. Calculate moving averages.
7. Calculate price, quantity, and value indices and interpret the results of each index.
8. Identify different methods of choosing a sample from a data population.
9. Identify the most common sampling biases.
10. Discuss the relationship between sampling reliability, sample size, and data dispersion.