

BUSI 444 Advanced Computer Assisted Mass Appraisal

PURPOSE AND SCOPE

The *Advanced Computer Assisted Mass Appraisal* course BUSI 444 is intended to give the real estate practitioner student a working knowledge of computer-assisted mass appraisal principles and practices. This course is unique in that it presents a hands-on approach to computer assisted mass appraisal techniques. Students will use a personal computer and statistical software to develop models designed to improve the consistency and quality of real property assessments.

The material is intended to be introductory in nature; it is important to keep in mind that study of this course by itself does not certify the reader as a qualified mass appraisal model builder. However, the course should give the student a solid foundation in mass appraisal which can be further enriched by real-world practice. Note that this course has been adopted by several jurisdictions as meeting their entry level employment requirements and it also meets the educational course requirements for professional accreditation in several appraisal and assessment organizations.

After reading the text and proceeding through the course workbook, the student should have a basic understanding of computer-assisted mass appraisal and the techniques involved in designing effective mass appraisal models. Listed below are general objectives for what a student should learn from this course. After completing the course, the student should be able to:

- Explain the importance of mass appraisal in real property tax assessment and discuss the practical application of computer-assisted modeling techniques.
- List and apply the statistical measures and techniques which form the basis for mass appraisal.
- Explain the general structure of mass appraisal models and be able to discuss the strengths and weaknesses of the various model types available.
- Describe methods for appraising land value using statistical modeling.
- Discuss the theory underlying the cost approach to value in terms of how this method is employed in property tax assessment.
- Develop a mass appraisal model based on the cost approach to value.
- Discuss the theory underlying the sales comparison approach to value in terms of how this method is employed in property tax assessment.
- Develop a mass appraisal model based on the sales comparison approach to value.
- Specify and calibrate additive multiple regression analysis (AMRA) models and multiplicative multiple regression analysis (MMRA) models.
- Develop a simple mass appraisal model based on non-linear regression techniques.
- Discuss the theory underlying the income approach to value and know how to develop a mass appraisal model based on the income approach.
- Test the performance of mass appraisal models in terms of accuracy and equity, by applying ratio studies.
- Explain how statistical testing procedures can be used in mass appraisal performance evaluation.

- Discuss geographic information systems (GIS) applications related to computer-assisted mass appraisal (CAMA) and explain the evolution towards CAMA/GIS integration.
- Discuss how neural networks can serve as an alternative to regression modeling, and develop a simple neural networks model.

LESSON 1 – Review of Statistical Software and Valuation Modeling Basics

1. Discuss the basis for mass appraisal and the capabilities, advantages, and disadvantages of various modeling methods;
2. Describe the steps in developing a mass appraisal model application;
3. Explain and interpret the statistics and graphics used in developing mass appraisal models; and
4. Use statistical software as a tool for creating and analyzing mass appraisal models.

LESSON 2 – Data Screening – Preparing Data for Modeling

1. Use graphic analysis to determine relationships between the given variables and the adjusted sale price;
2. Use graphic analysis to determine relationships among potential independent variables;
3. Use correlation analysis to determine relationships among potential independent variables;
4. Analyze a database to determine the need for a time adjustment and apply techniques to make any necessary time adjustments;
5. Analyze variables to determine the existence of outlier observations and determine the need to remove these;
6. Determine if there are enough observations of specific characteristics to allow the use of these in further regression modeling; and
7. Determine the need to transform variables for use in the modeling process.

LESSON 3 – Land Valuation Modeling

1. Evaluate and choose the most suitable method for land valuation given available sales information;
2. Develop a land residual for valuation situations where there are no vacant land sales available;
3. Develop a valuation model using land residuals and additive multiple regression;
4. Develop a valuation model using land residual and multiplicative multiple regression analysis;
5. Develop a land size adjustment factor based on land residuals;
6. Develop a land rate per unit using size adjusted land residuals; and
7. Test and adjust land values using land characteristics and locational factors.

LESSON 4 – Cost-Based Modeling

1. Specify and explain an appropriate model for mass appraisal using the cost method;
2. Use sale prices to develop a depreciation factor for the building portion of the cost model;
3. Transform variables to make use of the cost data provided in a building replacement cost calculation;
4. Calculate depreciated replacement cost new (RCN) for a property database;
5. Create appropriate market adjustment factors for variations in building characteristics;

6. Calculate a cost approach value by adding market adjusted building value to previously developed land value; and
7. Determine and apply needed adjustments for general factors such as location.

LESSON 5 – Sales-Based Modeling

1. Complete in-depth data screening and exploratory data analysis, building on the preliminary screening techniques demonstrated in Lesson 2, including transforming variables as necessary;
2. Apply the multi-step process for regression modeling to specify, calibrate, and test a sales-based valuation model;
3. Test the performance of the valuation model using a variety of parametric and non-parametric approaches, and make any necessary refinements;
4. Discuss the importance of testing the influence of individual variables not included in the final specified model; and
5. Test the model using a hold-out sample (sales data not used to develop the model) to determine its suitability for general valuation.

LESSON 6 – Advanced Sales-Based Modeling – Non-Linear Regression

1. Explain the basis for non-linear regression and outline how it differs from other model structures;
2. Describe the differences among additive, multiplicative, and hybrid models;
3. Identify the types of variables in a hybrid model and the form each variable may take;
4. Specify a non-linear model structure;
5. Correctly transform any variables to a proper format for use in non-linear regression;
6. Apply non-linear regression to calibrate a valuation model;
7. Test a non-linear valuation model using a training set (the data used to create the model) and make any necessary corrections; and
8. Test a non-linear model on a holdout sample (data not used to develop the model) to determine its usefulness for general valuation.

LESSON 7 – Income-Based Modeling

1. Develop a simple additive model for determining capitalization rates to assist in the valuation of apartment buildings;
2. Test the model, using the sales provided, to check the accuracy of the capitalization rate estimated and its usefulness in estimating sale price; and
3. Test the model by comparing its performance to traditional single property methods of estimating capitalization rates.

LESSON 8 – Integrating Geographic Information Systems and CAMA

1. Describe common applications for GIS in CAMA processes of data collection, data exploration, and model building;
2. Explain the main benefits of using GIS as a tool in CAMA processes;
3. Appreciate the importance of close collaboration between GIS and assessment staff in the assessment office;
4. Discuss the power of thematic maps in GIS processes to simplify complex data patterns and illustrate data issues that may otherwise be lost to the assessor; and
5. Describe and explain the trend to increasing integration of GIS and CAMA in the valuation process.

LESSON 9 – Neural Network Applications in Real Estate Analysis

1. Explain in basic terms how neural networks operate;
2. Use a neural network to conduct a simple real estate analysis;
3. Recognize the terms and models used in the neural network function of IBM SPSS;
4. Interpret neural network output from IBM SPSS;
5. Determine how to select the best neural network model to answer a given problem.

LESSON 10 – The Canadian CAMA Experience

1. Understand the evolution of CAMA systems in Canada;
2. Identify the forces influencing changes to CAMA systems and barriers to adoption of regression modeling in CAMA systems;
3. Describe the latest innovative mass appraisal practices and understand the extent of their application in CAMA systems; and
4. Forecast the future for the continued evolution of CAMA systems in Canada.