Spring 2-1-2022

CSCI 172.01: Introdution to Computer Modeling

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Introduction to Computer Modelling – Course Syllabus - Spring 2022

Course and Instructor Information

Sections: 01 and 50
Location: Based on registration
Instructor: Dr. Cheyenne Laue
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Office: MC 412, SS 206
Office Hours: TBD

Course Description

Students in this class will learn the fundamental aspects of computer modelling, with a focus on data acquisition, cleaning, exploration, analysis, and visualization.

Course Objectives

- Learn the basic strategies of computer modelling including explanation and prediction and the importance of modelling in fields ranging from science to business
- Learn the basics of data acquisition, including where to source data of different types, how to read and interpret supporting documentation, and how to appropriately cite and credit data sources
- Learn the basics of data cleaning, preparation, exploration and analysis using the Excel and Tableau toolkits
- Learn how to create meaningful and accurate data visualizations and supporting information/ documentation using the Excel, Tableau, Word, and PowerPoint toolkits.
- Learn the basics of implementing simple scripts in Excel in order to automate modelling procedures

Course Procedures

Academic Conduct

All students must practice academic honesty. Academic misconduct is subject to an academic penalty by the course instructor and /or a disciplinary sanction by The University. All students need to be familiar with the Student Conduct Code. The Code is available for review online at:
 http://www.umt.edu/vpsa/policies/student_conduct.php.

Collaboration

Using the Web to research materials and concepts is an integral part of learning in the twenty-first century. Studying with other students is a productive method of learning. A certain amount of collaborating on concepts with other students and using resources found on the Internet in an assignment is recommended. Copy and paste is not acceptable. It is expected that each student will input his/her assignment into the computer, and each student must be able to explain any assignment turned in. Collaboration on exams is strictly forbidden.

Dropping and Adding Courses or Changing Sections, Grading or Credit Status

University Policy for dropping courses or requesting grading/credit status changes can be found in the catalog: http://www.umt.edu/registrar/students/dropadd.php Students should become familiar with all academic policies found in the catalog.

Accommodations for Students with Disabilities

Eligible students with disabilities will receive appropriate accommodations in this course when requested in a timely way. Please contact me if you will be requesting an accommodation. Please be prepared to provide a letter from your DSS Coordinator. For more information, visit the Disability Services website at http://www.umt.edu/dss or call/text 406.243.2243.

COVID-19 Course Procedures

The University of Montana is requiring mask usage in all classrooms and laboratories regardless of vaccine status. New cases of COVID-19, predominately caused by the Delta variant of coronavirus, are increasing in Missoula County and across Montana. The University of Montana in following the Missoula City-County Health Department guidance recommends all individuals (regardless of vaccine status) also voluntarily wear a mask indoors and get vaccinated to help slow the spread of COVID-19. Because the conditions, rules, guidance, and recommendations surrounding the COVID-19 pandemic continue to evolve rapidly, these guidelines are subject to change. You are encouraged to stay up-to-date with the most current COVID-19 guidance using the resources listed at the end of these guidelines.

- If you feel sick and/or are exhibiting COVID-19 symptoms, please don't come to class and contact the Curry Health Center at **(406) 243-4330.**
- If you are required to isolate or quarantine, you will be supported, and it is the hope to ensure continued academic progress.
- Where social distancing (maintaining consistent 6 feet between individuals) is not possible, specific seating arrangements will be used to support contact tracing efforts.
- Class attendance and seating will be recorded to support contact tracing efforts.

Please refer to UM's Coronavirus student information page for more information and resources.

Course Assignments and Assessment

There are three main assignment categories on which students will be assessed in this course.

- **Explore** activities ask student to read and watch course materials relevant to the skills being built within each unit. Explore activities are designed to orient hands-on techniques within larger concepts and modelling frameworks and ask students to think about appropriate approaches to particular problems or questions posed by data sets. Explore quizzes test students on completion of reading and video material.
  - o **Warm-up** activities occur periodically throughout the course as precursors to the Explore materials. These activities include student surveys, discussion forums, and other short activities that ask students to engage with each other in the data collection process
- **Practice** activities ask students to take a hands-on approach to unit concepts and techniques. Practice activities guide students through data acquisition, cleaning, exploration, analysis, and visualization and ask students to use the skills introduced in the explore section activities. Practice quizzes require that students demonstrate correct analytical approaches to data sets,

including correct formatting of functions and formulas, correct results on analyses, and accurate visualizations.

- **Complete** activities ask students to work autonomously and apply the unit skills to specific data sets. The activities will require students to correctly approach problems or questions, to design and implement techniques for resolving or answering these, and to synthesize the results in accurate and insightful ways. Students are asked to take on a variety of professional roles while engaging with complete activities and produce reports, presentations, and other professional materials resulting from their data analyses.
- **Final Project** activities ask students to work autonomously to design research questions and analytic methods to gain insight from a provided data set. In addition, students will be required to contribute to a class survey designed to gather additional, complementary data points that can be integrated into the core project data set. Students spend the final three weeks of the class exploring, and analyzing, and creating interactive Tableau visualizations for their project.

Assignments	Grade Weighting
Explore and Warm-up	20%
Practice	30%
Complete	30%
Final Project	20%

Unit Topics and Assignments
Unit 1 January 18 - 23: Introduction to Modelling

This week we will examine the historical foundations of computer modelling and look at some of the ways in which computer models can be applied to solving, predicting, and explaining real-world problems, patterns, and processes. We will begin using Excel to manipulate data in order to gain clarity and insight from the data we find.

Topics:

- History of models
- Research questions and hypotheses
- Excel navigation and basic formatting and filtering

Assignments:

- Explore 1 and Quiz – Due Wednesday
- Practice 1 and Quiz – Due Friday
- Complete 1 Assignment and Quiz – Due Sunday

Data sets: Schelling Segregation, OWD Urbanization

Unit 2 January 24 - 30: Finding and Preparing Data

This week we familiarize ourselves with data types and formats and will gain some experience finding data from a variety of online resources and importing that data into Excel. We will learn to frame

questions about the data we find and will use basic Excel functions to explore some data. We will begin creating Excel Charts as an exploration and visualization tool.

Topics:

- Find data on the web
- Prepare data in different formats for import into Excel
- Read data documentation and cite data sources
- Use the COUNTIF, COUNTIFS, and TRANSPOSE functions
- Create basic charts in Excel

Assignments:

- Explore 2 and Quiz – Due Friday
- Practice 2 and Quiz – Due Sunday
- Complete 2 Assignment – Due Sunday

Data sets: Wikipedia Passwords, Oxford Comma Survey

Unit 3 January 31 – February 6: Cleaning and Preparing Data

This week we will learn some strategies for cleaning data sets that are not yet ready for analysis, including a variety of Excel functions and tools. We will also look at the statistical measure of correlation and use this function in Excel to see if we can find relationships between variables in a couple of data sets, including one collected via class survey.

Topics:

- Data cleaning and preparation
- CORREL function, functions for cleaning data, Find and Replace
- Create basic charts in Excel

Assignments:

- Warm up – Due Monday
- Explore 3 and Quiz – Due Friday
- Practice 3 and Quiz – Due Sunday
- Complete 3 Assignment – Due Sunday

Data sets: Candy Hierarchy, OSF Height and Shoe Size, Class Survey Data

Unit 4 February 7 – 13: Exploring and Analyzing Data

This week we will examine two industry safety data sets and use a variety of functions to determine what values are typical for the data and which values are extreme/ outliers. We will consider the implications of extreme values on analyses and develop an appreciation for the meaning of central tendency as well as when different statistical measures of centrality are meaningful.

Topics

- Basic cell references, semi-selection

- Central tendency, AVERAGE, MEDIAN, MIN, MAX functions
- Creating formulas
- Introduction to Tableau Visualizations

Assignments:

- Explore 4 and Quiz – Due Friday
- Practice 4 and Quiz – Due Sunday
- Complete 4 Assignment – Due Sunday

Data sets: Airline Safety Data 1984 – 2014, State-based Auto-Safety and Insurance Data

Unit 5 February 14 - 20: Exploring and Analyzing Data

This week will build on our previous week's discussion of central tendency by looking at variation and dispersion in our data sets. We will also think more about frequency distributions and learn to use these distributions to explain/ interpret the patterns underlying our data.

Topics:

- Measures of variation and dispersion, STDEV and VAR functions
- Frequency distributions
- ANOVA reports and COVARIANCE function
- Continue Tableau visualizations

Assignments:

- Explore 5 and Quiz – Due Friday
- Practice 5 and Quiz – Due Sunday
- Complete 5 Assignment – Due Sunday

Data sets: OWD World COVID Data, OWD Global Mental Health and Substance Use Disorder Data

Unit 6 February 21 - 27: Exploring and Analyzing Data 2

This week we will continue exploring patterns of similarity difference in our data sets by looking at population clustering. Using cluster analysis and comparison of means we will examine the ways in which large data sets are segmented into sub-groups/ populations.

- Cluster analyses, k-means
- Create scatterplots in Excel
- Continue Tableau Visualizations

Assignments:

- Explore 6 and Quiz – Due Friday
- Practice 6 and Quiz – Due Sunday
- Complete 6 Assignment – Due Sunday

Data sets: BLS Consumer Expenditure Survey, US Census Data

Unit 7 February 28 – March 6: Exploring and Analyzing Data 3

This week we will take a look and some useful functions for business and personal finance. We will learn to create tables based on variables of interest, and to use lookup and financial functions to calculate payments, interest, and create personal budgets.

Topics:

- Financial, logic, and lookup functions
- Create one and two variable data tables
- Continue visualizations in Tableau

Assignments:

- Explore 7 and Quiz – Due Friday
- Practice 7 and Quiz – Due Sunday
- Complete 7 Assignment – Due Sunday

Data sets: Loan Repayment/ Interest, Student's Budget Data

Unit 8 March 7 - 13: Exploring and Analyzing Data 4

This week we will create and manipulate pivot tables as a new form of data exploration and analysis. We will use the results of our exploration and practice work to create insightful, streamlined, and accurate reports using both large and small data sets.

Topics:

- Create Pivot Tables in Excel
- Use Pivot Tables to create reports

Assignments:

- Explore 8 and Quiz – Due Friday
- Practice 8 and Quiz – Due Sunday
- Complete 8 Assignment – Due Sunday

Data sets: OWD Global Deforestation, Small Business Sales

Unit 9 March 14 - 20: Exploring and Analyzing Data 5

This week we will learn more about optimization, forecasting, and prediction. Using Excel features we will generate suggestions/ recommendations/ solutions for problems presented in our data. This week's work will require that we extrapolate large-scale patterns from the individual data points contained within our data sets.

Topics:

- Optimization and forecast models using the Solver and What-If tools in Excel
- Create Forecast Reports and histograms in Excel
- Continue visualizations in Excel

Assignments:

- Explore 9 and Quiz – Due Friday
- Practice 9 and Quiz – Due Sunday
- Complete 9 Assignment – Due Sunday

Data sets: OWD Climate Change, Consumer Sentiment/ VIX and Meme Stocks

March 21 – 27 Spring Break

No Classes/ Assignments

Unit 10 March 28 – April 3: Excel Scripts 1

This week we will begin to explore the use of simple scripts in Excel, which allow us to automate commonly performed tasks. We will begin by playing with an implementation of John Conway's Game of Life, scripted in Excel and will learn to copy and run basic sample scripts to read cell data and alter formatting.

Topics

- Copying and Editing Scripts in the Code Editor
- Understanding Errors

Assignments:

- Explore 10 and Quiz – Due Friday
- Practice 10 and Quiz – Due Sunday
- Complete 10 Assignment – Due Sunday

Data sets: Ready Player One/ Game of Life, Excel Sample Data

Unit 11 April 4 - 10: Excel Scripts 2

This week we will continue to work with simple Excel scripts and expand our skill set through the creation of our own scripts. Using the Action Recorder feature, we will record a couple of simple scripts to perform calculations and format our work.

Topics

- Use action recorder to create scripts
- Understand common error messages

Assignments:

- Explore 11 and Quiz – Due Friday

- Practice 11 and Quiz – Due Sunday
- Complete 11 Assignment – Due Sunday

Data sets: TBD

Unit 12 April 11 - 17: Excel Scripts 3

This week we will use some Excel script templates to help us access and import resources into our workbooks. We will practice examining the code in the provided scripts and making alterations to the url and api sources as needed.

Topics

- Fetch data and images from external sources
- Alter scripts to change sources and formatting

Assignments:

- Explore 12 and Quiz – Due Friday
- Practice 12 and Quiz – Due Sunday
- Complete 12 Assignment – Due Sunday

Data sets: NOAA Water-Level Data, Excel Sample Data

Unit 13 April 18 - 24: Student Projects 1

This week we will start work on final projects, beginning with a general exploration of the core data set for the project. We will frame research questions for a class survey related to the core data set and will begin using Tableau's Dashboard feature to create interactive visualizations.

Topics

- Explore core data set for final project
- Frame research questions and submit research proposal
- Contribute questions to class survey
- Create Tableau dashboards and interactive dashboards

Assignments:

- Explore 11 and Quiz – Due Friday
- Practice 11 and Quiz – Due Sunday
- Complete 11 Assignment – Due Sunday

Data: BLS Education, Income, and Employment Data

Unit 14 April 25 – May 1: Student Projects 2

This week we will continue working with the core data set and incorporate the data obtained via class survey. We will learn a few more Tableau skills as well, which will be useful as we wrap up our final reports next week.

Topics

- Complete class survey
- Combine class survey, core data set as needed
- Conduct preliminary analyses
- Create Tableau Stories and Story Points

Assignments:

- Explore 14 and Quiz – Due Friday
- Practice 14 and Quiz – Due Sunday
- Complete 14 Assignment – Due Sunday

Data: BLS Education, Income, and Employment Data, Class Survey Data

Unit 15 May 2 - 8: Final Project

This week we will work on finishing up all analyses and visualizations for final projects. There are no unit assignments this week.

- Complete analyses and visualizations for final project
- Complete report/ presentation and submit

Unit 16 May 9 – 16: Final Exams

- Submit Final Project by Monday at midnight