COSC 405 (3) Modelling and Simulation Numeric dynamic systems models and emphasis on discrete stochastic systems. State description of models, common model components, entities. Common simulation language. Simulation using algebraic languages. Simulation methodology: data collection, model design, output analysis, optimization, validation. Elements of queuing theory, relationship to simulation. Applications to computer systems models. Credit will be granted for only one of COSC 405, DATA 405, COSC 505, or DATA 505. [3-2-0] Course Overview, Content and Objectives This course will provide an overview of statistical modelling and simulation techniques to students whose background is primarily in computer science and for those students who are studying data science. The course will begin with a review of the R Language for statistical and graphical programming. Course topics will include Monte Carlo simulation, including pseudorandom number generation and testing, simulation of discrete state stochastic processes as well as linear and nonlinear time series, elements of numerical linear algebra, and optimization. Objectives of the course are: to demonstrate how Monte Carlo simulation can be used to create realistic data scenarios; to demonstrate how digital computers can generate apparently random output; to demonstrate how simulation models can be used to assess the level of uncertainty in estimates and predictions, based on data. Learning Outcomes. After completing this course, students will be able to: construct functions and graphs using the R Language; construct and test basic pseudorandom number generators; simulate realistic data having a variety of dependence structures; assess the adequacy of various statistical models, graphically and through simulation; solve linear and quadratic programming problems.