Useful Preparatory Material for M.Sc. in Actuarial Science

The curriculum of the MSc program in Actuarial Science is under review. For the academic year 2020-2021, three revised actuarial graduate courses will be offered as Special Topics courses (ACMA-850).

Required Courses

Typically, Actuarial Science M.Sc. students starting in Fall 2020 will be required to take Statistical Theory (STAT-830) and the two ACMA 850 courses offered in their first semester at SFU.
In their second semester, they will take the ACMA-850 course offered and one or more elective courses subject to approval by their supervisor and the graduate program chair.

These requirements may be modified for students needing to complete a total of 36 units to graduate. See "Program Requirements" in http://www.sfu.ca/students/calendar/2020/fall/programs/actuarial-science/master-of-science.html.

Graduate students in Actuarial Science will not be given permission to accept a co-op position during their first two semesters at SFU (Fall 2020 and Spring 2021).

Review of the following material prior to starting these courses may prove useful.

1. Statistical Theory (STAT-830)
   - Course information, slides, and notes from Fall, 2013: http://people.stat.sfu.ca/~lockhart/richard/830/13_3/index.html
   - The probability sections of *Introduction to Mathematical Statistics* by Hogg, McKean, and Craig
   - Chapters 1--3 of *Probability and Statistics* by Evans and Rosenthal
   - Chapters 1--3 of *All of Statistics* by Wasserman. Also, it will likely be assumed that you can do the following problems in this book:
     - Chapter 1: Questions 5, 10-15, 17, 19, 20
     - Chapter 2: Questions 2, 4, 5, 9, 13, 14, 16-18, 20, 21
     - Chapter 3: Questions 1, 3, 4, 5, 10, 12-18, 21-24

2. Stochastic Processes for Insurance and Finance (ACMA-850 G100)
   Students should be familiar with undergraduate non-measure theoretic probability (e.g., random variables, common probability distributions, expectations, conditioning, independence, stochastic processes) and undergraduate option pricing theory (e.g., option parity, the binomial model, the Black-Scholes-Merton framework, hedging). Moreover, students should be familiar with statistical estimation (e.g., MLE, method of moments) and basic time series models (e.g., ARMA models, GARCH models). Solid coding skills are beneficial.

3. Advanced Actuarial Models (ACMA-850 G200)
   This course will cover five topics: aggregate claims modeling and evaluation, incurred but not reported (IBNR) claims modeling and reserving, bonus-malus system (BMS) for automobile insurance, classical risk process and ruin theory, and mortality models and mortality immunization.
   Students should know
   - the commonly used distributions for the number of claims and the severity of claims and their basic properties, the definition of (a,b,0) and (a,b,1) classes of distributions and their properties, the distribution of sums of independent random variables (including the use of convolution), and the compound models for aggregate claims especially the compound Poisson model;
   - conditional probability, conditional expectation, the Poisson process and its basic properties, credibility theory, commonly used estimation methods such as the maximum likelihood estimation method, and simple linear regression models;
   - level premiums and reserves for life and annuity products, Buhlmann credibility theory, | Bayesian theory.

   References
   - Chapters 6, 8, 9, 17 and 18 of Loss Models: From Data to Decision, 5th Edition by Klugman, Panjer and Willmot.
   - Chapters 2-7 of Actuarial Mathematics for Life Contingent Risks, 3rd Edition by Dickson, Hardy and Waters.

4. Actuarial Risk Management (ACMA-850 Special Topics to be offered in Spring 2021)
   This course focuses on concepts and tools related to risk management in the context of actuarial work. The topics covered will include economic perspectives on risk and insurance, risk measures, extreme value theory, multivariate risk models, risk management in practice.

Additional Material

- You will likely be using R (and potentially SAS as well) for statistical computing purposes. It would be helpful to learn the basics of the software before arriving. R can be freely downloaded at http://www.r-project.org
- You will likely be using LaTeX for writing technical documents (including your M.Sc. project). A basic understanding of how to use this software will be beneficial.
- If you will be a TA in the Statistics Workshop, review introductory statistics material (including linear regression) so that you are prepared to support students taking STAT 101, 201, 203, 270, and 302.
- The book Introduction to Mathematical Statistics by Hogg, McKean, and Craig may be helpful for learning (or re-learning) introductory material.