Useful Preparatory Material for a M.Sc. in Statistics or Actuarial Science

Required Courses

Typically, Statistics M.Sc. students take Statistical Theory and Linear Models in their first semester at SFU. Actuarial Science M.Sc. students normally take Statistical Theory and the ACMA 8xx course(s) offered. Review of the following material prior to starting these courses may prove useful.

1. ACMA 820: Stochastic Analysis of Insurance Portfolios

   - You should be familiar with survival models, insurance benefits, annuities, premiums, and policy values.
   - Chapters 2–7 of *Actuarial Mathematics for Life Contingent Risks* by Dickson, Hardy, and Waters.
   - Chapters 3–7 of *Actuarial Mathematics* by Bowers *et al.*

2. ACMA 821: Advanced Actuarial Models

   - You should be somewhat familiar with the following topics of Exam C/4 of the Society of Actuaries (`http://www.soa.org`): Severity models, frequency models, aggregate models, construction and selection of models.
   - *Loss Models: From Data to Decisions* (Third Edition), 2008, by Klugman, Panjer, and Willmot.

3. ACMA 822: Risk Measures and Ordering

   - You should be somewhat familiar with the following topics of Exams MLC and C/4 of the Society of Actuaries (`http://www.soa.org`): Survival models, insurance benefits, annuities, premiums, and policy values.
   - Chapters 2–7 of *Actuarial Mathematics for Life Contingent Risks* by Dickson, Hardy and Waters.
   - Chapters 3–7 of *Actuarial Mathematics* by Bowers *et al.*
   - The probability sections of *Introduction to Mathematical Statistics* by Hogg, McKean, and Craig.

4. <u>Statistical Theory</u>

- Course information and slides from Fall, 2011:
  `http://people.stat.sfu.ca/~lockhart/richard/830/11_3/index.html`

- Course notes from Fall, 2011:

  `http://people.stat.sfu.ca/~lockhart/richard/830/11_3/lectures/`
  `notes/web.pdf`

- 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

5. <u>Linear Models</u>

- The assignment at

  `http://people.stat.sfu.ca/cschwarz/Stat-LinearModels/Assignments/`
  `assign00-01.pdf`

- The following topics in *Applied Linear Statistical Models, 5th Ed.* by Neter, Kutner, Nachtsheim, and Li (**bolded** entries may be particularly important):
  - Simple and multiple linear regression
    * Least squares estimates
    * Inference: Hypothesis tests and confidence intervals
    * Correlation and R^2
    * Diagnostics
    * **Matrix approach**
    * **Random vectors, expectation, covariance matrix**
    * **ANOVA decomposition of sums of squares**
    * **Categorical explanatory variables and indicators**
    * **Weighted least squares**
  - Variable selection
    * Criteria
    * Algorithms: Stepwise, all possible subsets, LASSO/LAR
    * Multimodel inference and variable weights
    * Data splitting and validation

– Diagnostics
    * Added variable (partial regression) plot
    * Studentized deleted residuals
    * Leverage
    * Influence diagnostics
  – **Analysis of Variance**
    * Experiments and observational studies, **experimental units**
    * **Sums of squares**, **F-tests**
    * **Contrasts**
    * Diagnostics: **Equality of variance**, transformations

Additional Material

1. 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/`

2. 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.

3. 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.

4. Carl Schwarz has put together a set of course notes for beginning and intermediate statistics. These cover a broad range of topics and make an excellent reference. He also shows how to use R, SAS, and JMP to implement each method he presents, so the notes can be helpful for learning about these software packages as well. See `http://people.stat.sfu.ca/~cschwarz/CourseNotes/`

5. The book *Introduction to Mathematical Statistics* by Hogg, McKean, and Craig may be helpful for learning (or re-learning) introductory material.