This course (in combination with STA221) presents the basic statistical methodology used in many fields of application. It emphasizes conceptual thinking and the basic techniques that will be useful to students who seek to gain an understanding of the use of statistics in their own fields. Students seeking a more theoretical or mathematical development of the subject should consider taking STA 257+261. If you wish to pursue further studies in Statistics, you should follow up this course with STA255, which will provide some of the theory needed for such study.

Tutorials - starting May 16

Tutorials meet for two hours per week, Tuesday and Thursday 6-7pm (followed by lectures). The major purpose of tutorial is discussion and review of course material; no new material will be covered. In preparation for tutorial, you should do the weekly assignment, which will be posted at the course web page. *Assignment #1 (to be posted at the web site) is due at your first tutorial.* These assignments will be discussed at tutorial.

There will be some brief assessment grade at each tutorial (0 – 5 scale) based on either a short quiz or classroom discussion/participation or submission of part of the assignment due. These are meant to be easy marks to encourage you to keep up with the work; do not view this as very meaningful feedback on your achievement level or your preparedness for tests. At the end of term, your TA will submit a 0 -10 grade for you. All TAs will be required to submit similar grades at course end (i.e. similar percentage of 10's, 9's, etc.), regardless of whether their quiz average is 2 or 5, so there will be no disadvantage due to your TA's particular approach. We expect the majority of students who make a steady effort to receive at least 9 marks out of 10.

The location of your tutorial will be posted on the course web page prior to 10am, May 16. Records are kept by tutorial so please attend the one you are properly enrolled in, *to prevent missing marks.*

If you miss a tutorial/quiz due to illness, late enrolment, etc., please discuss with your TA, and not your lecturer or the course coordinator. Your TA has full discretionary power to deal with, and adjust tutorial grades for, such things. If ill, bring some proof.

Course Content

Content, emphasis, etc. of the course is defined by means of the lecture - *not the texts.* It is important to attend all lectures, as there is normally no simple way to make up for missed lectures. There will also be many lecture examples using Minitab, the statistical software chosen for this course. *Important announcements, problem sets, handouts, practice tests, tutorial and aid centre info, etc., will be posted on the course homepage,* or occasionally emailed out. **So check the web site (via the portal) and your UTORmail account regularly.**

Required Texts

(1) *Stats: Data and Models, First Canadian Edition,* by DeVeaux, Velleman, et al (Pearson). Do not purchase U.S. editions of the text.
(2) **Minitab Workbook 2012 Revised & Updated,** by A. Vukov (CSPI). Do not purchase earlier versions.

We strongly recommend that you buy the DeVeaux text *bundled together* with Minitab software CD (student release 14), which gives you the Minitab software at *a big discount* (if you can run Windows software). **Don't confuse the Minitab software installation CD with the text resource DVD which is included with every text.** Note that Minitab software runs only on the Windows operation system. But alternatively, note that Minitab software will be available to everyone via the CQUEST computing labs on campus (see *Computing* below).

You can avoid some frustration, by ordering online from the bookstore: www.uoftbookstore.com/online/
The web site www.mymathlab has additional learning aids such as online quizzes and exercises, interactive applets, podcasts, animations, and a student solutions manual. Your lecturer will give you the required access code for this course.

Additional Sources of Help (starting May 16)

Your primary source of help with difficulties is your TA in the scheduled tutorial, but additional assistance will be available at the **Statistics Aid Centre**, Room 1091, in Sidney Smith Hall and perhaps also at the **CQUEST** computing site in the Ramsey Wright building (info at www.cquest.utoronto.ca). A schedule will be posted at the course website. Your own TA will be available for help at one or both of these sites for a total of two hours per week, but you can always drop in on any Sta220 TA present.

Additional Help

There are electronic discussion forums at the course web page where you can communicate with other students in the course, as well as with the course lecturers (please use in place of email). For very general administrative queries, the Statistics departmental office can be reached at stats@utstat.utoronto.ca or 416-978-3452.

Evaluation

Your tutorial grade is worth 10% of your final grade. The remaining portion of your grade will be equal to either {0.35 x Term Test + 0.55 x Final Exam}, or {0.15 x Term Test + 0.75 x Final Exam}, whichever is higher.

The date and time of the term test is: June 4, 6pm, rooms: TBA

Though tests/exams place a very minor emphasis on formulae, you are allowed a one-sided 8-1/2"x 11" (standard letter size) hand-written aid sheet on the term test (two-sided on final exam). **Programmable calculators are not permitted on tests or exam. You must bring your student identification to term tests as well as the final exam.** The final exam will consist of 30 multiple-choice questions (5 choices each). A correct answer receives 3.33 marks. An unanswered question receives 0.67 marks.

Missed Tests

There are **no make-up tests**. Should you miss the term test due to illness, you are required to submit, within one week the proper University of Toronto "Verification of Student Illness or Injury" form. For more information, go to http://www.illnessverification.utoronto.ca. *The test's weight will then be shifted to the exam.* **If this documentation is not received, your test mark will be zero.**

Calculators

Hand calculators are cheap and useful. Any cheap one with a square root button and basic memory will do. Mean, standard deviation, sum, and sum of squares keys may save you a bit of time on occasion, but we do not recommend the purchase of expensive calculators to get keys with special statistical calculations. Tests and exams will be designed so that those calculators give no advantage. We emphasize the use of Minitab software for doing any tedious or complex calculations.

Computing

Students will be using, on a weekly basis, the Minitab Statistical Computing Software, either at home (if you purchase the student version of Minitab bundled inexpensively with the text), or at the CQUEST computing facilities at the University of Toronto - go to www.cquest.utoronto.ca for info about accounts, rooms, hours of operation, etc. You will use this software to analyze data sets used in the text exercises. These data sets can be found on the DVD accompanying the textbook, or at the web site http://wps.pearsoned.ca/ca_ph_deveaux/204/52457/13429053.cw/index.html or at www.mymathlab.com. It is also possible to lease Minitab (professional version) for short-term use at www.minitab.com/academic (click on *Pricing and Licensing*), and to download a 30-day free trial version from the www.minitab.com website.

CQUEST computing accounts may be obtained by going to www.cquest.utoronto.ca and clicking on '*Request an Account*'. If you do not purchase and install Minitab on your home computer, you will need this CQUEST account to use Minitab at CQUEST sites on campus (it is not possible to log on to CQUEST's Minitab program from your home).

You will use Minitab on nearly every assignment. **Always bring to tutorial the full computer output,** along with your written answers. Computing problems frequently arise, so do your assignment early, and be prepared to come back another day or time, if the printer gets jammed, etc. Expect no special consideration by your TA for 'technical' problems'.

Academic Offences

Academic offences are unacceptable and harm everyone. E.g., some students have been known to alter a test paper after it is graded, and then re-submit it hoping for more marks - really! But, offenders are caught, and **sanctions can be severe** - zero in the course with annotation on the transcript for several years; suspension for a year; even expulsion. Various measures, announced and unannounced, will be taken throughout the year to reduce their incidence and to ensure successful prosecution (photocopying of graded tests, multiple versions of multiple choice exams, etc.). And please carefully note the following:

- ❖ Requests for a test remark will be considered only if you *write your test in ink.*
- ❖ *Grading oversights* such as addition errors and overlooked work must be reported to your TA *immediately* upon receiving your test paper at class. *So check it over as soon as you get it back.*

Feel free to discuss weekly assignments with others, but in the end, be sure to do all the computations, work and final write-up by yourself (i.e. plagiarism is unacceptable).

Accessibility Needs

The University of Toronto is committed to accessibility. If you require accommodations for a disability, or have any accessibility concerns, please contact Accessibility Services as soon as possible: disability.services@utoronto.ca or http://studentlife.utoronto.ca/accessibility

Final Comments

For most students, Statistics is a new subject. Like most new subjects, it seems difficult at first but simple in retrospect. Many new concepts will be introduced and built upon. The course will be far easier and more useful if you master concepts and terminology as they are introduced - *similar to learning a new language.* Doing the exercises is not like calisthenics or jogging, which are good for you no matter how your mind wanders as long as you go through the motions. *Think about the objectives of the study, why a particular method was used, and what has been learned about the original questions that motivated the study!*

The lecturers and TA's are there to help. Ask questions! If you have any comments or suggestions about the course, please tell us. We want to know what is good; we want to know when problems are developing. Remember that it takes time for information to travel and for action to be taken. Therefore, if you become aware of any problems, mention this to your instructors right away.

STATISTICS 220F (SUMMER 2013) LECTURE GUIDE – TENTATIVE
Textbook (SDM 1st Cdn edition by DeVeaux, et al) chapter references are in parentheses.
Do many of the odd problems in SDM for practice (the answers for these are at the back of the text, with longer solutions in the students solutions manual)

Lecture 1: Introduction to course, overview. Cases and variables, categorical & quantitative variables: Worksheet organization of data. Relative frequency distribution. Bar charts & Pie Charts for categorical variables. Two way tables; marginal and conditional distributions. Simpson's paradox. Introduction to Minitab. Quantitative variables: dotplots and histograms. Shapes of distributions, outliers. (2-4)

Lecture 2: Stem and leaf plots. Timeplots. Summation notation. Sample mean, median, mode (modal class), trimmed mean. Resistant measures. Standard deviation. The empirical rule. Calculating mean & standard deviation for grouped data. Percentiles. 5-number summary & boxplots. Comparing distributions. (4 -5)

Lecture 3: z-scores. Linear and non-linear transformations of data. Density curves and the normal distribution. Normal probability (quantile) plot. Bivariate data: Scatterplots & correlation. Cautions. (6-7)

Lecture 4: Regression and the least-squares line, coefficient of determination, residual plots, outliers & influential observations; lurking variables, association & causality. (7-9)

Lecture 5: Collecting data: Observational studies and randomized experiments. Designing experiments: comparison, randomization, blocking, factorial design. Sample vs population characteristics. Random samples: SRS, stratified, systematic, cluster & multistage. Sampling and non-sampling errors. Bias. (12, 13)

Lecture 6: Probability and relative frequency. Sample space, outcomes, and events. Rules of calculation for probabilities. Conditional probability (with a Bayes example via tree diagram). Statistical independence. Estimating probabilities by computer simulation. Two useful counting rules (combinations, sequential operations). (11, 14, 15)

Lecture 7: Discrete random variables and probability functions. Expectation (mean) and variance of random variables and linear combinations (e.g. sums, differences, averages). The binomial distribution, applications, mean and variance (using sums of Bernoulli variables), the sample proportion. (16-17)

Lecture 8: Continuous random variables and density functions. Normal approximation of binomial distribution. Sampling distributions. Distribution of the sample mean (and total). The Central Limit Theorem. (17-18)

Lecture 9: Margin of error, Confidence Intervals for μ (σ known / large n) and p (large sample), and sample size. Exact and Plus 4 confidence intervals for p. Statistical tests of hypothesis: observed and fixed levels of significance (P-value, α-level). The z-test for p and for μ (σ known or large sample). (19-20)

Lecture 10: Decision errors - types I & II, and power (with a z-test calculation). Testing hypotheses via confidence intervals. Statistical vs. practical significance. Multiple tests and data snooping. Test & C.I. for μ with unknown variance: the Student t distribution. Robustness of t procedures (via simulations). Power of the t-test (using graphs or Minitab). (21, 23)

Lecture 11: Two independent samples: large sample z-test & C.I. for comparing the means. Small sample t-tests comparing two population means: pooled & unpooled variance procedures. Paired comparison t-test, and a nonparametric (distribution-free) approach - the sign test. Comparing designs: paired comparison vs. independent groups. Robustness, transformations, power (via Minitab). (24-25)

Lecture 12: Comparing two proportions with z-test. Additional topics. Final case study (video: the AZT trials). Overview of inferential procedures. (22, TBA)