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**UNIVERSITY OF TORONTO**
**DEPARTMENT OF STATISTICS**

**STA247 H1 F – Probability with Computer Applications**
**Course Outline – Fall 2013**

**class time & location  (L0101):   Mon 3-5 pm, Fri 3-4 pm   ES 1050**
**optional tutorial time & location:   Fri 4-6 pm   ES B149**

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| **Instructor:** | J.G. Pitt |
| **Office Location:** | SS 6017 |
| **Office Telephone:** | tba |
| **Email:** | greg.pitt@utoronto.ca |
| **Office Hours:** | Monday   2:10-2:50 pm,  SS 6017 |
| | Friday   2:10-2:50 pm,  SS 6017 |
| **TAs:** | tba |

**Official Course Description**

Introduction to the theory of probability, with emphasis on applications in computer science.  The topics covered include random variables, discrete and continuous probability distributions, expectation and variance, independence, conditional probability, normal, exponential, binomial, and Poisson distributions, the central limit theorem, sampling distributions, estimation and testing, applications to the analysis of algorithms, and simulating systems such as queues
(Note: STA247H1 does not count as a distribution requirement course).

Prerequisite: MAT135Y1/MAT137Y1/MAT157Y1; CSC108H1/CSC148H1
Exclusion: ECO227Y1/STA257H1
Distribution Requirement Status: This is a "None" course
Breadth Requirement: The Physical and Mathematical Universes (5)

**Course Objectives**

The successful student will learn the basics of probability.  These concepts will be applied to a wide variety of settings, including the business and economics environments.

**Main Text:**

Grinstead & Snell:  *Introduction to Probability*, 2nd revised ed., AMS, 1997

**Supplementary Books:**

Higgins & Keller:  *Concepts in Probability and Stochastic Modeling*, 1994
Ross:  *Introduction to Probability Models*, 10th ed., Academic Press, 2010

**Determination of Grades**

| assignments | 5%, 7%, 8% | Sept 23, Oct 25, Nov 15 |
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| quizzes | 7%, 8% | Sept 27, Nov 22 |
| mid-term exam | 25% | tentatively October 22, time & room t.b.a. |

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| final exam | 40% | December ??  (t.b.a. by Faculty) |
| TOTAL | 100% | |

clean drop:   2013/11/04  -  last day to drop this course from academic record and GPA .

## Requirements and Criteria
Three assignments will be collected.  You may consult with your fellow students, but each student must submit individual answers and document his/her thought processes.

Problem sets, consisting of questions assigned from the book as well as supplementary questions, will be posted from time to time.  These questions are for practice and discussion and not for handing in and grading.

The mid-term test will take place in mid-October, on a date to be determined soon.  It will probably NOT be administered during class hours.  It may include any material covered up to the end of the previous class, unless stated otherwise in class.

The final exam will emphasize material since the mid-term, but may still include questions from earlier material in the course.

For the various tests, students will be permitted to use a non-programmable, non-plotting calculator.  If there is any doubt about the permissibility of your particular calculator, please consult in advance.

***Students must bring their U of T student ID to all quizzes, tests, and exams.***

## Conduct of Classes
Ordinary classroom etiquette is expected of all of the students.  This includes arriving on time, turning off cell phones and similar devices, and respect for fellow students.

Leaving the classroom while a lecture is in progress is disruptive and should be avoided.  If you feel that you will need to leave class before it ends, please sit close to the rear doors and alert the instructor to your situation.

The class time will be used for lectures and discussion, based mostly on the material in the textbook.  However, the instructor may assign additional reading and/or exercises to supplement the book.

Class participation is strongly encouraged: asking questions, comments that relate this course to others that you are taking, pointing out mistakes on the chalkboard, etc.

The course website will be the centre for communication from the instructor to the students. The students are urged to complete the recommended problem sets.  Solutions to some of these problems may be posted on the course web-site.

**The Statistics Aid Centre**  can be an important source of help with difficulties.  There are, in fact, two locations: Sidney Smith 1091, and New College Wetmore 68A.  Your designated TA will be on duty at least one hour per week, but you may drop in at any time if you are willing to wait for other students to be served.  Schedules will be posted as soon as they become available.  Some additional

information may be available at  http://www.utstat.utoronto.ca - click on Statistics Aid Centres for the schedule.


**Procedures and Rules**

**Email:**  The instructor and the TAs may be contacted by email at any time.  In general, the TAs should be contacted regarding subject matter, and the instructor regarding administrative matters.  Note that if message traffic becomes excessive, the course email policy may be revised at any time during the term.

**Missed Tests:**  In the event a student misses the mid-term exam due to illness or domestic situation, the student must contact the Statistics departmental office immediately, and submit a medical certificate indicating type of illness and date of illness (or other applicable documentation for domestic situations) to the instructor.  This should be done <u>within 48 hours of the test date</u>, if possible.

If a student misses a quiz or the mid-term for legitimate reasons, the missing points will be earned through a combination of alternative testing and weight shifting:  One half of the missing points will be determined by a special examination, and the next major test or exam will be determine the other half. The special examination will be in the instructor's office and will consist of a number of written and oral questions sufficient to evaluate the student's understanding of topics that were on the missed quiz or test.

**Programming languages**:  The official primary programming language for this course is R, and the official secondary language is Python.  Both languages are available on numerous campus computers, and they are free to install on a student's personal computer.  Students should use R for assignments, projects, etc., and should use Python only when a task is seemingly impossible or incredibly inconvenient in R.  No other languages will be supported by the instructor and TAs.

**Quizzes**:  The printed quizzes may contain a superset of questions, from which your specific questions will be determined on the basis of your student number.

**How to present your work**:  On assignments and tests, make sure that your final answers are not difficult to find.  When asked to supply one answer, do not give two.  Show your work (i.e., document your thought processes).  Some wrong answers may be awarded partial credit, but not unless you show your work. **Careless rounding and similar sloppiness will result in deductions.**  Cover pages are not required for the assignments.

**Marking issues:**  The TAs and the instructor are well aware of the importance of grades to most students, and great care will be taken in the marking of assignments, quizzes, and exams.  In the unlikely event that you feel a question has been mis-marked, or the marks have been added up incorrectly, you can submit your test back to the instructor with a note explaining what you believe requires further examination.  This must be done within one week of the test being returned to the class.

**Cancellation policy:**  In the event of inclement weather, instructor illness, or similar circumstances resulting in class cancellation, any quiz or assignment due date will be postponed until the next class. Minor adjustments to the overall course schedule might be necessary, and these will be posted.

Formal rules are in place regarding the rescheduling of final exams, and these will be followed if

necessary.

**Accessibility:** Students with diverse learning styles and needs are welcome in this course. In particular, if you have a disability or health consideration that may require accommodations, please feel free to approach me and/or the Accessibility Services Office as soon as possible. The Accessibility Services staff are available by appointment to assess specific needs, provide referrals and arrange appropriate accommodations. The sooner you let them and me know your needs, the quicker we can assist you in achieving your learning goals in this course.

For more information, please refer to   http://www.accessibility.utoronto.ca/

**Academic integrity** is fundamental to learning and scholarship at the University of Toronto. Participating honestly, respectfully, responsibly, and fairly in this academic community ensures that the U of T degree that you earn will be valued as a true indication of your individual academic achievement, and will continue to receive the respect and recognition it deserves.

Familiarize yourself with the University of Toronto's *Code of Behaviour on Academic Matters* (http://www.governingcouncil.utoronto.ca/policies/behaveac.htm). It is the rule book for academic behaviour at the U of T, and you are expected to know the rules. Potential offences include, but are not limited to:

In papers and assignments:
- Using someone else's ideas or words without appropriate acknowledgement.
- Copying material word-for-word from a source (including lecture and study group notes) and not placing the words within quotation marks.
- Submitting your own work in more than one course without the permission of the instructor.
- Making up sources or facts.
- Including references to sources that you did not use.
- Obtaining or providing unauthorized assistance on any assignment including
  - working in groups on assignments that are supposed to be individual work,
  - having someone rewrite or add material to your work while "editing".
- Lending your work to a classmate who submits it as his/her own without your permission.

On tests and exams:
- Using or possessing any unauthorized aid, including a cell phone.
- Looking at someone else's answers
- Letting someone else look at your answers.
- Misrepresenting your identity.
- Submitting an altered test for re-grading.

Misrepresentation:
- Falsifying or altering any documentation required by the University, including doctor's notes.
- Falsifying institutional documents or grades.

The University of Toronto treats cases of academic misconduct very seriously.  All suspected cases of academic dishonesty will be investigated following the procedures outlined in the *Code*.  The consequences for academic misconduct can be severe, including a failure in the course and a notation

on your transcript. If you have any questions about what is or is not permitted in this course, please do not hesitate to contact the instructor. If you have questions about appropriate research and citation methods, seek out additional information from the instructor, or from other available campus resources like the U of T Writing Website. If you are experiencing personal challenges that are having an impact on your academic work, please speak to the instructor or seek the advice of your college registrar.

Note that because of crowding in the classroom, multiple versions of the quizzes and mid-term exam may be administered. The differences between versions will be slight and should not affect the difficulty of particular problems.


**Topic Outline** - The following topics will be covered, and in approximately this order:

I. Probability theory; events [G&S 1&2]
  definitions: probability, event, sample space; random, distribution
  n equally probable events
  set operations (intersection, union, complement, difference)

II. combinatorics [G&S 3]
  selection & counting

III. two or more variables [G&S 4]
  joint, marginal; independence, mutEx
  addition and multiplication rules
  conditional probability; Bayes' rule

IV. distributions and random variables [G&S 6-8, 10]
  discrete vs continuous
  random variables, pdf/pmf, cdf, icdf
  parametric distributions
  expected value, variance [G&S 6]
  moment generating functions; characteristic functions [G&S 10]
  law of large numbers [G&S 8]
  linear combinations of RVs; joint distributions [G&S 7]
  distribution relationships (binom/norm, t/norm, gamma/negB)
  conditional expectation & variance

V. stochastic processes & simulation [G&S 11,12]
  Markov chains; graph theory [G&S 11]
  random walk [G&S 12]
  counting processes; Poisson processes; waiting times; queue service
  random number generation; seeds

VI. intro to statistics [G&S 9]
  distribution of the mean; central limit theorem [G&S 9]
  probability vs statistics; PSM
  goodness of fit

VII. applied probability & advanced topics