# University of Guelph
# Department of Mathematics and Statistics
# Fall 2021

# STAT*2120: Probability & Statistics for Engineers

# Course Outline

## General Information

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**Class Schedule** : Online
**Location** : Courselink
**Campus** : Guelph

**Credit Weight** : 0.50

**Prerequisites** : One of IPS*1510, MATH*1210, MATH*2080

**Restrictions** : STAT*2040, STAT*2060, STAT*2080, STAT*2230

**Final Examination** : December 9, 2021, 8:30 – 10:30 am

## Instructor Information

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**Instructor Name** : Peter Kim
**Instructor Email** : stat2120@uoguelph.ca
**Office Phone** : (519) 824-4120 Ext. 58165
**Office location** : MACN515 (will not be used Fall 2021)
**Office hours** : TBA via Zoom

## GTA Information

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**GTA Name** : Meghana Munipalle
**GTA Email** : mmunipal@uoguelph.ca

**GTA Name** : Thiyaana Jeyabalan
**GTA Email** : jeyabalt@uoguelph.ca

## Course Resources

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### Course Texts:

### Required Text:

Probability & Statistics for Engineers: Course Notes for STAT*2120 Fall 2021 - Available in the university bookstore.

### Recommended Text:

$9^{th}$ edition of Probability & Statistics for Engineers & Scientists by Walpole, Myers, Myers and Ye.

A hard copy of the text is on reserve in the McLaughlin Library Reserve Collection. Additional supplementary exercises are available here.

### Other Resources:

**Course website:** courselink.uoguelph.ca

### Mathematics and Statistics Department Learning Centre

- Drop-in virtual environment where students can ask statistics teaching assistants to help them with questions or to explain concepts related to course material
- Location and hours:

  Virtual through Courselink/Resources

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| Monday and Wednesday | 9:30 am – 3:30 pm |
| Tuesday and Thursday | 10:00 am – 4:00 pm |
| Friday | 9:30 am – 2:30 pm |

### Online discussion boards

- Online discussion boards will be available on Courselink.
- They are only to be used for course-related matters.
- Students are encouraged to help each other understand concepts and discuss assignment questions; however you are not allowed to share answers.
- Discussion boards will be monitored for accuracy and content.

### Calendar Description:

The topics covered in this course include: Sample spaces; probability, conditional probability and independence; Bayes' theorem; probability distributions; probability densities; algebra of expected values; descriptive statistics; inferences concerning means, variances, and proportions; curve fitting, the method of least squares and correlation. An introduction to quality control and reliability is provided. This course is recommended for students in the B.Sc.(Eng.) program.

### Course Description:

The topics covered in this course include: Sample spaces; probability, conditional probability and independence; Bayes' theorem; probability distributions; probability densities; algebra of expected values; descriptive statistics; inferences concerning means, variances, and proportions; curve fitting, the method of least squares and correlation. Time permitting, an introduction to quality control and reliability may be provided. This course is recommended for students in the B.Sc.(Eng.) program.

## Course Policies

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### Grading Policies

#### Assignments

- There will be weekly assignments under the Quizzes tab in Courselink.
- Before an assignment is closed, students are allowed unlimited attempts and a time limit is not enforced.
- The last submitted attempt will count toward your assignment mark for each assignment.
- The lowest assignment mark out of the 10 assignments will be dropped.
- Missed assignments will obtain a mark of zero.

#### Respondus

- There is a “Practice Test and Monitor”, also under the Quizzes tab. It is a practice test designed to help you with Respondus Lockdown Browser and does not count toward your grade.

#### Midterms and Final

- Midterm 1, Midterm 2 and Final are online closed book and uses **Respondus.** Please do the Practice test to get familiar with the software.
- A formula sheet and statistical tables will be made available as needed.
- A standard scientific calculator is available for all tests and the final.

- Students who would like academic accommodations should contact Accessibility Services (SAS).

**Course Policy on Group Work:**

- Students are allowed and encouraged to work together on assignments and problem sets and to use the online discussion board on Courselink to help each.
- However, submitted answers for assignments must be a students' own work.

**Accommodation due to Illness:**

- The University will not normally require verification of illness (doctor's notes) for Fall 2021 semester courses. However, requests for Academic Consideration may still require medical documentation as appropriate.

## Course Content

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**Specific Learning Outcomes:**

- After successful completion of this course, students will be able to
- Create and interpret numerical and graphical data summaries.
- Interpret probability and work out basic probability calculations.
- Explain the design and techniques involved in basic experimental studies, sample surveys and random sampling.
- Correctly perform basic statistical analysis on a set of data by selecting the correct inference procedure and being able to report the results. This includes creating confidence intervals and performing tests of hypotheses.
- Correctly interpret statistical results reported by others.
- Make conclusions based on statistical inference techniques and justify their decisions.
- Perform regression analysis and justify the use of a linear model for data prediction. This includes performing inference on the slope.

**Lecture Content:**

Statistical Thinking

- Population and samples, parameters and statistics, types of variables, types of studies, random sample, goal of statistical inference

Descriptive Statistics

- Sample mean, sample variance and sample standard deviation, median, mode, quartiles, percentiles, linear transformations
- Introduction to summation notation and other standard mathematical notation
- Bar charts pie charts, histograms, boxplots, stem-and-leaf plots, outliers

Probability

- Introduction to set notation (unions, intersections, complements)
- Mutually exclusive events, conditional probability, independent events
- Venn diagrams, tree diagrams, Bayes' Theorem
- Factorial, combinations, permutations

Introduction to Discrete and Continuous Random Variables

- Definition of random variable, probability distributions, expected value and variance of a random variable
- Bernoulli distribution, binomial distribution, the normal distribution (including reading the standard normal tables)

Confidence Intervals

- Basic concepts, introduction and motivation, assumptions
- One sample on the mean and on proportions
- Two sample on a difference of means and on a difference of proportions

Hypothesis Testing

- Basic concepts, introduction and motivation
- Level of significance, rejection regions, Type I and Type II errors
- One sample on the mean and on proportions
- Two sample on a difference of means and on a difference of proportions

Linear Regression

- Least squares model, residuals and residual plots, assumptions, correlation coefficient, coefficient of determination, confounding variables, inference on the slope

**Lecture Schedule:**

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| Week 1 | Sep 13 | Statistical Thinking - Chapter 1:<br>Assignment 1<br>-start Sep 13 at 9am due Wed Sep 22 at 11:59 pm |
| Week 2 | Sep 20 | Descriptive Statistics – Chapter 2:<br>Assignment 2<br>-start Sep 22 at 9am due Wed Sep 29 at 11:59 pm |
| Week 3 | Sep 27 | Probability – Chapter 3:<br>Assignment 3 |

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| | | -start Sep 29 at 9am due Wed Oct 6 at 11:59 pm |
| Week 4 | Oct 4 | Probability – Chapter 3: |
| Midterm 1 | Oct 7 | Time limit 60 minutes available from 6:00 pm to 9:00 pm online with Respondus Lockdown. |
| Week 5 | Oct 11 | Common Randon Variables (Discrete) – Chapter 4:<br>Thanksgiving break. Course resumes Wed Oct 13.<br>Assignment 4<br>-start Oct 13 at 9am due Wed Oct 20 at 11:59 pm |
| Week 6 | Oct 18 | Common Randon Variables (Continuous) – Chapter 4:<br>Assignment 5<br>-start Oct 20 at 9am due Wed Oct 27 at 11:59 pm |
| Week 7 | Oct 25 | Foundations of Inference – Chapter 5:<br>Assignment 6<br>-start Oct 27 at 9am due Wed Nov 3 at 11:59 pm |
| Week 8 | Nov 1 | Confidence Intervals – Chapter 6: |
| Midterm 2 | Nov 4 | Time limit 60 minutes available from 6:00 pm to 9:00 pm, online with Respondus Lockdown. |
| Week 9 | Nov 8 | Hypothesis Tests – Chapter 7:<br>Assignment 7<br>-start Nov 8 at 9am due Wed Nov 17 at 11:59 pm |
| Week 10 | Nov 15 | Hypothesis Tests – Chapter 7:<br>Assignment 8<br>-start Nov 17 at 9am due Wed Nov 24 at 11:59 pm |
| Week 11 | Nov 22 | Linear Regression - Chapter 8:<br>Assignment 9<br>-start Nov 24 at 9am due Wed Dec 1 at 11:59 pm |
| Week 12 | Nov 29 | Linear Regression – Chapter 8:<br>Assignment 10<br>-start Wed Dec 1 at 9 am due Sun Dec 5 at 11:59 pm |
| Final Exam | Dec 9 | Time limit 120 minutes available from 8:30am to 10:30am, online with Respondus Lockdown. |

## Course Assignments and Tests:

**Assignments 10%**

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| Assignment 1 | Sep 22 (Wed) | Deadline 11:59 pm | Online on Courselink |
| Assignment 2 | Sep 29 (Wed) | Deadline 11:59 pm | Online on Courselink |
| Assignment 3 | Oct 7 (Wed) | Deadline 11:59 pm | Online on Courselink |
| Assignment 4 | Oct 20 (Wed) | Deadline 11:59 pm | Online on Courselink |
| Assignment 5 | Oct 27 (Wed) | Deadline 11:59 pm | Online on Courselink |
| Assignment 6 | Nov 3 (Wed) | Deadline 11:59 pm | Online on Courselink |
| Assignment 7 | Nov 17 (Wed) | Deadline 11:59 pm | Online on Courselink |
| Assignment 8 | Nov 25 (Wed) | Deadline 11:59 pm | Online on Courselink |
| Assignment 9 | Dec 1 (Wed) | Deadline 11:59 pm | Online on Courselink |
| Assignment 10 | Dec 5 (Sun) | Deadline 11:59 pm | Online on Courselink |

**Midterm Tests 40%**

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| Midterm 1 (20%) | Oct 7 | Open on Oct 7<br>6:00 pm to<br>9:00 pm. | Online on Courselink<br>Respondus Lockdown |
| Midterm 2 (20%) | Nov 4 | Open on Nov 4<br>6:00 pm to<br>9:00 pm. | Online on Courselink<br>Respondus Lockdown |

**Final 50%**

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| Final Exam | Dec 9 | Open on Dec 9<br>8:30 am to<br>10:30 am. | Online on Courselink<br>Respondus Lockdown |

## University Statements

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### Disclaimer

Please note that the ongoing COVID-19 pandemic may necessitate a revision of the format of course offerings and academic schedules. Any such changes will be announced via Courselink and/or class email. All University-wide decisions will be posted on the COVID-19 website and circulated by email.

### Email Communication

As per university regulations, all students are required to check their e-mail account regularly: e-mail is the official route of communication between the University and its students.

### When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. The grounds for Academic Consideration are detailed in the Undergraduate and Graduate Calendars.

Undergraduate Calendar - Academic Consideration and Appeals
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml

Graduate Calendar - Grounds for Academic Consideration
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml

Associate Diploma Calendar - Academic Consideration, Appeals and Petitions
https://www.uoguelph.ca/registrar/calendars/diploma/current/index.shtml

### Drop Date

Students will have until the last day of classes to drop courses without academic penalty. The deadline to drop two-semester courses will be the last day of classes in the second semester. This applies to all students (undergraduate, graduate and diploma) except for Doctor of Veterinary Medicine and Associate Diploma in Veterinary Technology (conventional and alternative delivery) students. The regulations and procedures for course registration are available in their respective Academic Calendars.

Undergraduate Calendar - Dropping Courses
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml

Graduate Calendar - Registration Changes
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/genreg-reg-regchg.shtml

Associate Diploma Calendar - Dropping Courses
https://www.uoguelph.ca/registrar/calendars/diploma/current/c08/c08-drop.shtml

**Copies of Out-of-class Assignments**

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

**Accessibility**

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required; however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to book their exams at least 7 days in advance and not later than the 40th Class Day.

For Guelph students, information can be found on the SAS website
https://www.uoguelph.ca/sas

For Ridgetown students, information can be found on the Ridgetown SAS website
https://www.ridgetownc.com/services/accessibilityservices.cfm

**Academic Integrity**

The University of Guelph is committed to upholding the highest standards of academic integrity, and it is the responsibility of all members of the University community-faculty, staff, and students-to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff, and students have the responsibility of supporting an environment that encourages academic integrity. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

Undergraduate Calendar - Academic Misconduct
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml

Graduate Calendar - Academic Misconduct
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml

**Recording of Materials**

Presentations that are made in relation to course work - including lectures - cannot be recorded or copied without the permission of the presenter, whether the instructor, a student, or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

**Resources**

The Academic Calendars are the source of information about the University of Guelph's procedures, policies, and regulations that apply to undergraduate, graduate, and diploma programs.

Academic Calendars https://www.uoguelph.ca/academics/calendars

**Mental Health Services**

One out of every five students in Canada experiences some sort of mental health issue at some point in their academic career. If you find yourself facing a mental health crisis, or just need to talk to someone, please consider taking advantage of one of the following resources available to University of Guelph students:

*Counselling Services:* Visit the Counselling Services website (https://wellness.uoguelph.ca/counselling) to get information on resources available to you, both online and in-person. You can also visit them at Health Services (J.T. Powell Building, ext 53244) where they offer individual and group counselling sessions by appointment or walk-in.

*Student Support Network:* is located in the Wellness & Education Promotion Centre in the J.T. Powell Building and offers confidential, peer-based, drop-in support.

*Good2Talk:* (1-866-925-5454) is a free, 24/7 student hotline that provides professional

counselling and referrals for mental health, addictions and well-being.

*Here 24/7:* (1-844-437-3247) specializes in assessment, referral and appointment booking and is available 24/7 for crisis support.

You are not alone, and you will not be judged for asking for help.