**Instructor: Hiro Kasahara**

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Course webpage: http://faculty.arts.ubc.ca/hkasahara/econ325.html

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**Time and Location:** Tuesday and Thursday 12:30-14:00, Buchanan A202

**Office Hours:** Tuesday 11:00-12:00 or by appointment

**Teaching Assistant:** Juan Riano Rodriguez (email: jf.riano@alumini.ubc.ca)

**Lab Sessions:** Monday 17:00-18:00 BUCH B215

**Textbook (required)**: Newbold, Carloson, and Thorne, *Statistics for Business and Economics, 8th edition* [The older edition is also fine.]

**Other References (not required)**: (i) *Introductory Statistics* by OpenStax, (ii) Hogg, Tanis, and Zimmerman, *Probability and Statistical Inference*

In addition to textbook, supplementary lecture notes are available on the course webpage. Note that these lecture notes are meant to be supplemental and not the substitute for textbook. You have to read textbook to understand the class materials.

**Course Description**:

This course is an introduction to probability and statistics and covers some basic tools for the statistical analysis of economic data. Topics include descriptive statistics, random variables and probability distributions, confidence interval estimation and hypothesis testing. This will give students the preparation for Economics 326.

The prerequisites for Economics 325 are: All of Econ 101, Econ 102, Math 104 (or course equivalent), and Math 105 (or course equivalent). Courses equivalent to MATH 104 as a prerequisite are MATH 100, 111, 120, 140, 153, 180 and 184. For MATH 105 the equivalents are MATH 101, 103, 121, 141, and 154. Students are expected to be familiar with basic concepts in calculus.

**Assignments**:

There will be eight assignments. No work will be accepted after the lecture on the due date, unless a written proof of the emergency situation that causes the delay is provided. If a student finds a problem in grading of a problem set, she/he should immediately talk to the TA.

When you submit your homework assignments, you can submit as a group of two or three (but not four, i.e., the maximum number of each group is three). If you like, you can do your assignment by yourself and submit it as an individual rather than as a group. When you submit your assignment as a group, please make sure that the names and student IDs of all members of your group are written on the assignment. Everyone in the same group will get the same score for each assignment. Please don't be a free rider. Asking your classmates to put your name on an assignment when you do not do anything on the assignment is prohibited. All members of the group must work together to complete an assignment if you submit your assignment as a group.

Many of the assignment questions are from textbook as well as past assignments/exams. Please do not copy and paste the answer you find over internet. If you copy and paste without understanding the content, this is often obvious to me and the TA, and you may fail the course.

**Clicker Questions**:

Review questions using clicker will be asked in class. 5 out of 100 percent of the final percent grade will be assigned to clicker questions, all of which will be given to participation regardless of your answers. Please bring clicker to every class period. You are responsible for registration online and bring the device to class. If you don't have one, you can buy used or new clickers at the UBC bookstore. Your Econ 325 Canvas page has a clicker registration link and use this link if you have not already registered your clicker for another course. You must have a registered clicker by midnight, 11:59PM, Tuesday September 17th, 2019 (last day for change in registration). Your answer to clicker questions will count towards your grade starting on Thursday, September 19th. Please refer to more information at: http://wiki.ubc.ca/Documentation:Clickers#Student_Info.

If you have any issue, please let me or our TA know. Please do not cheat with clicker (e.g., asking someone else to use your clicker or answer remotely while you are not there). I will occasionally count the number of students in class and compare it with the number of answers from clicker.

**No Laptop Use in Classrooms**:

You are not allowed to use laptop in classroom. There is empirical evidence against laptop use in classrooms—students with laptop computers often perform unrelated task and "the level of laptop use was negatively relate d to several measures of student learning" (Carrie, 2008). More importantly, evidence also suggests that the use of laptop computers has negative externality to nearby peers" (Sana, Weston, and Cepeda, 2013) because your fellow students will be destructed when you are searching over internet. The exception is the use of tablet: you may use tablet on flat surface for note-taking by writing directly with stylus. No typing via keyboards, though.[1]

**Grading:**

**Assignments (20% of the final grade), Clicker Questions (5%), a midterm exam (30%), a final exam (45%).** The final exam will be cumulative and will cover all content covered during the term. In computing the final grade, the worst homework assignment will be ignored. While assignments receive relatively low weights, completing assignments is very important. In the past years, the average final percent grade among students who did not regularly submit assignments was 43 percent, and the majority of them received F. This suggests that, if you do not complete assignments, you are likely to fail this course.

**Midterm Exam**:

**The midterm exam will be held in class from 12:30-14:00 on Thursday, October 17.** There will be no make-up exam for the midterm exam. If you miss your midterm exam for various reasons, all of your midterm exam weight will be shifted to your final exam (i.e., the weight for your final exam for the course grading will be 30+45=75 %).

**In-term Concession**:

Arts Students must contact Arts Advising as soon as you are aware you may need an in-term concession. Please review their website for concession criteria as well as process to follow:

https://students.arts.ubc.ca/advising/academic-performance/
help-academic-concession/

Students in other Faculties should contact their Faculty advising office for direction.

**UBC-wide Policy Statement**:

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[1]There is evidence that writing leads to better learning than typing. See http://pss.sagepub.com/content/early/2014/04/22/0956797614524581.abstract.

UBC provides resources to support student learning and to maintain healthy lifestyles but recognizes that sometimes crises arise and so there are additional resources to access including those for survivors of sexual violence. UBC values respect for the person and ideas of all members of the academic community. Harassment and discrimination are not tolerated nor is suppression of academic freedom. UBC provides appropriate accommodation for students with disabilities and for religious and cultural observances. UBC values academic honesty and students are expected to acknowledge the ideas generated by others and to uphold the highest academic standards in all of their actions. Details of the policies and how to access support are available here ([https://senate.ubc.ca/policies-resources-support-student-success](https://senate.ubc.ca/policies-resources-support-student-success))

**Topics** (Corresponding chapters in Newbold, Carloson, and Thorne):

1. **Describing Data: Numerical** (Ch 2).

2. **Probability** (Ch 3).

3. **Discrete Random Variables and Probability Distributions** (Ch 4).

4. **Continuous Random Variables and Probability Distributions** (Ch 5).

5. **Sampling and Sampling Distributions** (Ch 6).

6. **Estimation** (Ch 7 and 8).

7. **Hypothesis Testing** (Ch 9 and 10).

**Learning Outcomes:**

Upon successful completion of the course, the student should be able to:

- Calculate and interpret summary statistics including mean, median, mode, variance, standard deviation, coefficient of variation, covariance, and correlation.

- Understand the properties of probability and learn various concepts such as conditional probability, marginal probability, statistical independence, and Bayes' theorem.

- Define expected value, variance, standard deviation, covariance, correlation, statistical independence, mean independence, and uncorrelatedness using the probability mass function or the probability density function.

- Mathematically prove various properties of expectation, variance, covariance, conditional mean, and conditional variance.

- Understand the property of a normal random variable and calculate the probability that a normal random variable falls below some constant using the standardized normal table.

- Explain the concept of random sampling a sampling distribution and how it is different from population distribution.

- Understand the Law of Large Numbers and the Central Limit Theorem and how to use them to make statistical inference.

- Approximate the distribution of the sample average of Bernoulli random variable using the central limit theorem.

- Understand what the distribution of sample variances is when the population distribution is normal.

- Explain what the chi-square distribution is.

- Estimate the mean and the variance in the population from a sample.

- Understand the concept of bias, unbiasedness, and efficiency of a point estimator.

- Explain the concept of consistency and how it is different from unbiasedness.

- Calculate and interpret confidence interval of the population mean or the population proportion when the sample size is large.

- Calculate and interpret confidence interval of the population mean when the sample size is small but the population distribution is known to be normal.

- Explain what Student's t distribution is.

- Calculate and interpret confidence interval of population variance when the population is normally distributed.

- Find the tail probability of a Chi-square distributed random variable from the Chi-square table.

- Estimate the difference in population mean or proportion.

- Calculate and interpret confidence interval of the difference in population mean or proportion when the sample size is large.

- Conduct hypothesis testing on the single population.

- Explain the concepts of the null hypothesis, the alternative hypothesis, significance level, critical value, rejection region, decision to reject or not, Type I error, Type II error, power of the test, and how to compute the power.

- Conduct hypothesis testing on the difference in population mean or proportion.