DAWSON COLLEGE

Mathematics Department

Probability & Statistics – Science

201 – BZS – 05

COURSE OBJECTIVES

For details, see "Dawson Science Program".

COURSE COMPETENCIES

This course will allow the student to fully achieve the competency:

00UV: To apply the methods of descriptive and inferential statistics to analyze data.

Elements of the Competency:

1. To describe data statistically.
2. To calculate the probability of an event.
3. To make statistical inferences.

This course also contributes to the partial achievement of the competency:

00UU: To apply what they have learned to one or more subjects in the sciences.

Elements of the Competency:

1. To identify the scientific aspects of a given topic from an interdisciplinary perspective.
2. To transfer what they have learned to situations requiring the contribution of more than one discipline.
3. To apply systematically an experimental method.
4. To solve problems.
5. To use data processing technologies.
6. To reason with rigor.
7. To communicate clearly and precisely.
8. To show evidence of independent learning in the choice of documentation or laboratory instruments.
9. To work as members of a team.
10. To make connections between science, technology and the evolution of society.
11. To identify the underlying values underlying their treatment of a topic.
12. To place scientific concepts used in a historical context.
13. To show attitudes appropriate for scientific work.

PRE-REQUISITE

Good standing in Calculus II (201 – NYB – 05) or equivalent.

PONDERATION

3-2-3

EVALUATION SCHEME AND SCHEDULE

The Institutional Student Evaluation Policy (ISEP) is designed to promote equitable and effective evaluation of student learning and is therefore a crucial policy to read and understand. The policy describes the rights and obligations of students, faculty, departments, programs, and the College administration with regard to evaluation in all your courses, including grade reviews and resolution of academic grievance. ISEP is available on the Dawson website.

Term Work

The term work is based on a minimum of 4 ½ hours of tests/quizzes. A minimum of 3 class tests will be given.

Final Examination

The Final Examination will be a supervised, comprehensive examination held during the formal examination period.

Grading Policy

***Term Work* (*assignments, computer labs, quiz and tests*):** 60%

***Final Examination*:** 40%

Comprehensive Examination:
N.B. For a Science (200.xx) student who elects to do the Comprehensive Evaluation (CE) in this section, the teacher will either evaluate the CE on a pass/fail basis or make it worth 10% of the final grade.

IF A STUDENT FAILS THE ASSESSMENT (*i.e. obtains less than 60%*), *HE/SHE CANNOT GRADUATE*.

To pass the course, the students must obtain at least 60%.

REQUIRED TEXT AND MATERIALS

Text: The required text is *STAT* ^{2} by Johnson & Kuby (*ISBN-10: 0-538-73841-3*), publisher Brooks/Cole

References: (1) *Statistics for the Sciences* by Buntinas & Funk

(2) *Understanding Basic Statistics* (*2nd Edition*) by Brase & Brase

Calculators: A scientific calculator, which has no text storage or graphing capabilities, is required for class tests and the final exam.

TEACHING METHODS

Lectures and problem sessions.

ATTENDANCE AND COURSE PARTICIPATION REQUIREMENTS

Students should refer to the Institutional Student Evaluation Policy (ISEP section III-C) regarding attendance. *Attendance is recommended for the successful completion of the course.*

LITERACY STANDARDS

Problem solving is an essential component of this course. Students will be expected to analyze problems stated in words, to present their solutions logically and coherently, and to display their answers in a form corresponding to the statement of the problem, including appropriate units of measurement. Marks will be deducted for work which is inadequate in these respects, even though the answers may be numerically correct.

STUDENT OBLIGATIONS

(a) Students have an obligation to arrive on time and remain in the classroom for the duration of scheduled classes and activities.

(b) Students have an obligation to write tests and final examinations at the times scheduled by the teacher or the College. Students have an obligation to inform themselves of, and respect, College examination procedures.

(c) Students have an obligation to show respectful behavior and appropriate classroom deportment. Should a student be disruptive and/or disrespectful, the teacher has the right to exclude the disruptive student from learning activities (classes) and may refer the case to the Director of Student Services under the Student Code of Conduct.

(d) Electronic/communication devices (including cell phones, mp3 players, etc.) have the effect of disturbing the teacher and other students. All these devices must be turned off and put away. Students who do not observe these rules will be asked to leave the classroom.

Everyone has the right to a safe and non-violent environment. Students are obliged to conduct themselves as stated in the Student Code of Conduct and in the ISEP section on the roles and responsibilities of students. (ISEP section II-D)

ACADEMIC INTEGRITY

Cheating in Examinations, Tests, and Quizzes

Cheating includes any dishonest or deceptive practice relative to formal final examinations, in-class tests, or quizzes. Such cheating is discoverable during or after the exercise in the evaluation process by the instructor. Such cheating includes, but is not limited to:

a. copying or attempting to copy another's work.

b. obtaining or attempting to obtain unauthorized assistance of any kind.

c. providing or attempting to provide unauthorized assistance of any kind.

d. using or possessing any unauthorized material or instruments which can be used as information storage and retrieval devices.

e. taking an examination, test, or quiz for someone else.

f. having someone take an examination, test, or quiz in one's place.

Unauthorized Communication

Unauthorized communication of any kind during an examination, test, or quiz is forbidden and subject to the same penalties as cheating.

Plagiarism on Assignments and the Comprehensive Examination

Plagiarism is the presentation or submission by a student of another person's assignments or Comprehensive Assessment as his or her own. Students who permit their work to be copied are considered to be as guilty as the plagiarizer.

Penalties

Cheating and plagiarism are considered extremely serious academic offences. Action in response to an incident of cheating and plagiarism is within the authority of the teacher.
Penalties may range from zero on a test, to failure in the course, to suspension or expulsion from the college.

According to ISEP, the teacher is required to report to the Sector Dean all cases of cheating and plagiarism affecting a student's grade. (see ISEP section IV-C.)

INTENSIVE COURSE CONFLICTS & POLICY ON RELIGIOUS OBSERVANCE

If a student is attending an intensive course, the student must inform the teacher, within the first two weeks of class, of the specific dates of any anticipated absences.

Students who wish to observe religious holidays must also inform each of their teachers in writing within the first two weeks of each semester of their intent to observe the holiday so that alternative arrangements convenient to both the student and the teacher can be made at the earliest opportunity. The written notice must be given even when the exact date of the holiday is not known until later. Students who make such arrangements will not be required to attend classes or take examinations on the designated days, nor be penalized for their absence.

It must be emphasized, however, that this College policy should not be interpreted to mean that a student can receive credit for work not performed. It is the student's responsibility to fulfill the requirements of the alternative arrangement.

Students who intend to observe religious holidays or who take intensive courses must inform their teachers in writing as prescribed in the ISEP Policy on Religious Observance. (ISEP Section III-D).

A form for this purpose is available at the end of this document.

MATH TUTORIAL ROOM

Volunteer math teachers are available for help in room 7B.1 from 10:00 to 16:00 (Monday through Friday) and from 17:00-18:00 (Monday through Thursday).

COURSE CONTENT & TENTATIVE SCHEDULE

(number of classes listed is approximate)

DESCRIPTIVE STATISTICS: (9 classes)

DESCRIPTIVE STATISTICS (*Chapters 1, 2*)
Descriptive Analysis and Presentation of Single Variable Data

SECTION & *Topics*	**HOMEWORK**
1.1 WHAT IS STATISTICS? *Measurements, Levels of Measurement*	p.17 #1.7 – 1.17 1.20 – 1.25
1.2 MEASURABILITY and VARIABILITY	p.20 #1.27 – 1.31
1.3 DATA COLLECTION	p.20 #1.32 – 1.40
2.1 GRAPHS, PARETO DIAGRAMS AND STEM-AND-LEAF DISPLAYS *Dot plots, Stem-and-leaf displays*	p.50 #2.1 – 2.6
2.2 FREQUENCY DISTRIBUTIONS AND HISTOGRAMS *Histograms, Ogives, Frequency distribution tables, Classes, Class width, Class boundaries, Class marks, Relative frequency, Cumulative frequency*	p.50 #2.7 – 2.11
2.3 MEASURES OF CENTRAL TENDENCY *Mean, Median, Mode*	p.51 #2.12 – 2.16
2.4 MEASURES OF DISPERSION *Range, Sample variance, Sample standard deviation*	p.51 #2.17 – 2.22
2.5 MEASURES OF POSITION *Quartiles, Percentiles, Standard Scores, Five number summaries, Box-plots*	p.52 #2.23 – 2.27
2.6 INTERPRETING AND UNDERSTANDING STANDARD DEVIATION *Empirical Rule, Chebyshev's Theorem*	p.52 #2.28 – 2.31

DESCRIPTIVE STATISTICS (*Chapter 3*)
Descriptive Analysis and Presentation of Bivariate Data

3.1 BIVARIATE DATA *Bivariate data, Scatter diagrams*	p.70 #3.3 – 3.9
3.2 LINEAR CORRELATION *Coefficient of linear correlation, coefficient of determination*	p.71 #3.12 – 3.15, 3.18 – 3.20
3.3 LINEAR REGRESSION *Line of best fit, Making predictions*	p.72 #3.23 – 3.25, 3.27 – 3.29

PROBABILITY: (12 classes)

PROBABILITY (*Chapter 4*)

SECTION & ***Topics***	**HOMEWORK**
4.1 PROBABILITY OF EVENTS *Theoretical (expected) probability, Empirical probability, Sample space*	p.95 #4.1 – 4.7, 4.11
4.2 CONDITIONAL PROBABILITY OF EVENTS *Conditional probability*	p.96 #4.12 – 4.15
4.3 RULES OF PROBABILITY *Complementary events, Addition rules, General Multiplication rule, Conditional probability*	p.97 #4.16 – 4.23, #25 – 27
4.4 MUTUALLY EXCLUSIVE EVENTS *Mutually exclusive events, Special Addition Rule*	p.97 #4.28 – 4.35
4.5 INDEPENDENT EVENTS *Independent events, Dependent events, Special Multiplication Rule*	p.98 #4.36 – 4.44
4.6 ARE MUTUAL-EXCLUSIVENESS AND INDEPENDENCE RELATED? *Using conditional probability to determine independence*	p.99 #4.45 – 4.50
ADDITIONAL SECTION I: BAYES' THEOREM *Bayes' Theorem, Tree diagrams*	Exercises distributed in class
ADDITIONAL SECTION II: COUNTING TOOLS *Fundamental Counting Principle, Permutations, Combinations, Combining the rules of probability, Venn diagrams*	Exercises distributed in class

PROBABILITY DISTRIBUTIONS (*Chapter 5*)
Probability distributions and Discrete Variables

5.1 RANDOM VARIABLES *Random variables*	p.113 #5.3 – 5.6
5.2 PROBABILITY DISTRIBUTIONS OF A DISCRETE RANDOM VARIABLE *Probability distribution, Probability function* *Mean (expected value), variance, standard deviation*	p.113 #5.7 – 5.23, 5.26 a – c
5.3 THE BINOMIAL PROBABILITY DISTRIBUTION *Binomial probability experiments, Binomial probability function* *Mean, standard deviation of binomial distribution*	p.115 #5.27 – 5.32, 5.34 – 5.54 a - g

ADDITIONAL SECTION III: POISSON DISTRIBUTION — Exercises distributed in class
Poisson distribution, Mean of Poisson Distribution, Applications of Poisson Distributions

ADDITIONAL SECTION IV: THE HYPERGEOMETRIC DISTRIBUTION — Exercises distributed in class
Hypergeometric distribution (*sampling without replacement*), *Comparison of binomial and hypergeometric distributions*

CONTINUOUS PROBABILITY DISTRIBUTIONS (*Chapter 6*)
Continuous probability distributions, Normal probability distributions

SECTION & *Topics*	**HOMEWORK**
6.1 NORMAL PROBABILITY DISTRIBUTION *Normal probability distribution function*	p. 132 # 6.1, 6.2
6.2 STANDARD NORMAL DISTRIBUTION *Properties of standard normal distribution, Finding area under standard normal curve*	p.132 #6.3 – 6.19
6.3 APPLICATIONS OF NORMAL DISTRIBUTION *Probabilities, Percentiles*	p.133 #6.20 – 6.26
6.4 NOTATION *z-scores, critical values* z_α	p.134 #6.29 – 6.35
6.5 NORMAL APPROXIMATION OF THE BINOMIAL *Normal approximation to the binomial, continuity correction factor*	p.134 #6.36 – 6.47

ADDITIONAL SECTION V: PROBABILITY DENSITY FUNCTIONS — Exercises distributed in class
Probability functions, definite and improper integrals, expected value and variance, applications

ADDITIONAL SECTION VI: EXPONENTIAL DISTRIBUTIONS — Exercises distributed in class
Mean and variance of exponential distributions

SAMPLE VARIABILITY (*Chapter 7*)

SECTION & *Topics*	**HOMEWORK**
7.1 SAMPLING DISTRIBUTIONS *Sampling distribution of a sample statistic, Creating a sampling distribution of sample means*	p.148 #7.1, 7.2, 7.6, 7.8
7.2 THE SAMPLING DISTRIBUTION OF SAMPLE MEANS *Mean and variance of sampling distribution of sample mean, Central Limit Theorem*	p.149 #7.9 – 7.14

7.3 APPLICATION OF THE SAMPLING DISTRIBUTION OF SAMPLE MEANS p.150 #7.18 – 7.29
Calculating probabilities for the mean

INFERENTIAL STATISTICS: (21 classes)

INTRODUCTION TO STATISTICAL INFERENCES (*Chapter 8*)

8.1 THE NATURE OF ESTIMATION p.178 #8.1 – 8.9
Point estimate, Interval estimate, Level of confidence, Confidence interval

8.2 ESTIMATION OF MEAN μ (σ KNOWN) p.178 #8.10 – 8.20
Point estimate, Confidence interval, Sample size

8.3 THE NATURE OF HYPOTHESIS TESTING p.179 #8.21 – 8.32
Statistical hypothesis test, Null Hypothesis, Alternative Hypothesis, Type I and II errors

8.4 HYPOTHESIS TEST OF MEAN μ (σ KNOWN): A PROBABILITY VALUE APPROACH p.180 #8.33 – 8.39
Probability value hypothesis test (p-value approach), One-tailed and Two-tailed tests

8.5 HYPOTHESIS TEST OF MEAN μ (σ KNOWN): A CLASSICAL APPROACH p.181 #8.41 – 8.44
Critical values, One-tailed and Two-tailed tests

INFERENCES INVOLVING ONE POPULATION (*Chapter 9*)

9.1 INFERENCES ABOUT THE MEAN μ (σ UNKNOWN) p.203 #9.1 – 9.18
Properties of the t-Distribution, Confidence Intervals, Hypothesis Testing (*p-value and classical approach*)

9.2 INFERENCES ABOUT THE BINOMIAL PROBABILITY OF SUCCESS
Confidence Interval for a Proportion, p.205 #9.19 – 9.33
Hypothesis Test for a Proportion (*p-value and classical approach*)

INFERENCES INVOLVING TWO POPULATIONS *(Chapter 10)*

10.1 DEPENDENT AND INDEPENDENT SAMPLES p.230 #10.1 – 10.5

10.2 INFERENCES CONCERNING THE MEAN DIFFERENCE p.230 #10.6 – 10.17
Dependent samples, Confidence intervals and hypothesis testing of paired differences

ADDITIONAL SECTION V: DEGREES OF FREEDOM FOR INFERENCES CONCERNING DIFFERENCE BETWEEN MEANS
Independent samples, Confidence intervals and hypothesis tests
The Equal Variances Case vs Satterthwaite's Formula
(*This Additional Section should be covered before exercise set 10.3*)

SECTION & ***Topics***	**HOMEWORK**
10.3 INFERENCES CONCERNING THE DIFFERENCE BETWEEN MEANS *Independent samples, Confidence intervals and hypothesis testing*	p.232 #10.18 – 10.24
10.4 INFERENCES CONCERNING THE DIFFERENCE BETWEEN PROPORTIONS *Independent samples, Confidence intervals and hypothesis testing for difference of proportions*	p.233 #10.27 – 10.36
APPLICATION OF CHI-SQUARE (*Chapter 11*)	
11.1 CHI-SQUARE STATISTIC *Observed and Expected Values, Test Statistic for Chi-Square*	p.250 #11.2, 11.3
11.2 INFERENCES CONCERNING MULTINOMIAL EXPERIMENTS *Multinomial experiments,* *Degrees of freedom for multinomial experiments*	p.252 #11.4 – 11.16
11.3 INFERENCES CONCERNING CONTINGENCY TABLES *Test of Independence, Contingency Tables*	p.252 #11.17 – 11.26
ADDITIONAL SECTION VI: TESTING FOR NORMALITY *Chi-Square test for normality*	Exercises distributed in class
ADDITIONAL SECTION VII (OPTIONAL): LINEAR CORRELATION *Testing for significance*	Exercises distributed in class
USING MODERN TECHNOLOGY:	
ADDITIONAL SECTION VIII: USING EXCEL *Statistical and graphing software will be demonstrated in class and will be required in completing assignments.*	Exercises distributed in class

Lab Report Requirements:

All text and formulas must be word-processed.

All graphs must be computer-generated.

RELIGIOUS OBSERVANCE/ INTENSIVE COURSES FORM

Students who intend to observe religious holidays or who take intensive courses must inform their teachers in writing as prescribed in the ISEP Policy on Religious Observance. (ISEP Section III-D)

The following form must be submitted within the first two weeks of classes.

Name: _____

Student Number: _____

Course: _____

Teacher:_____

Date:	**Description:**
_____	_____
_____	_____
_____	_____
_____	_____