University of Waterloo STAT 230 – W. H. Cherry

STATISTICS 230

Winter, 1989

This course is intended to introduce students to *probability* and its applications. Probability is the basis of stochastic *modelling* in statistics, and in a number of other areas such as actuarial science, computer science, operations research, theoretical physics and the biological sciences. Checking the *adequacy* of a mathematical model requires that suitable *data* be available.

TEXT: Strongly recommended – Kalbfleisch, J.G. *Probability and Statistical Inerence. Volume I. Probability.* Second Edition, Springer-Verlag, 1985.

TOPICS: *Introduction*: Probability models, combinatorial probability.
The Calculus of Probability: Union, intersection, probabilistic independence, conditional probability.
Discrete Random Variables: Hypergeometric, binomial, Poisson and negative binomial distributions; approximations; multinomial distribution.
Continuous Random Variables: Histograms; uniform, exponential and normal distributions; joint distributions.
Expectation: Definitions; mean and variance; linear combinations; covariance.
Normal Approximations: Central limit theorem; continuity correction. (*More details are given overleaf*)

INSTRUCTOR/T.A.: W. H. Cherry, Department of Statistics & Actuarial Science, / P. Merkouris, Statistics & Actuarial Science, Office MC 6153, telephone 888-4482. / Office MC 2005, extension 6657.

OFFICE HOURS: *Instructor* – Monday, Wednesday and Friday, 10.30 to 11.30 a.m.; Monday, 3.30 to 4.30 p.m.; by appointment (if *really* necessary). Students must make proper use of the scheduled tutorials for assistance with assigned problems.
T.A. – Tuesday, 4 to 5 p.m.; Thursday, 1.30 to 2.30 p.m.; Friday, 1 to 3 p.m.

ASSIGNMENTS: There are ten (10) assignment sheets for the course; they contain from 12 to 17 problems each. These problems are classified as follows: type **A** ("assigned"), usually five in number, which *every* student should do on a weekly basis; type **S** ("supplementary"), which provide further practice, for those who wish to make use of it, of basically the same ideas as the assigned problems; type **B** ("bonus"), for students who have time and inclination to tackle a few more challenging problems. Solutions of assignment problems are *not* to be submitted for grading and they do *not* count towards the final mark for the course; however, these problems will be the basis of two quizzes and the final examination (see below). Students are encouraged to work cooperatively together on assignments.

TUTORIALS: The weekly tutorials will take up the *assigned* problems from the assignments; the tutorial schedule is given overleaf. It is anticipated that this will be the *only* source of assistance for these problems. Help with the *supplementary* problems can be obtained (primarily) from the T.A. or (secondarily) from the instructor. In either case, it is *essential* to bring your *written* attempt at a problem when you seek assistance – little help can be provided to someone who says only that they cannot even start a problem. Outline solutions of the *supplementary* problems will be posted in the Tutorial Centre, room MC 3004.

QUIZZES: Two 2-hour quizzes will be held in rooms MC 1050 and MC 1052 from 5 to 7 p.m. on Tuesday, February 7, and on Tuesday, March 7; details of their contributions to final marks and the topics they cover are given below and overleaf. A tentative format for each quiz is *six* questions – two from the assigned problems of the relevant assignments, two from the supplementary problems, and two other questions; the first four questions might have either but not both of the numbers and the context changed from the corresponding assignment question. A similar format is envisaged for the final examination, except that there would be *nine* (instead of six) questions. A formula sheet is permitted for the second (but **NOT** the first) quiz; it is subject to the same restrictions as the formula sheet for the final examination (see below).

ASSESSMENT: Each student's final mark in the course will normally be made up as follows:

Quiz #1	20%
Quiz #2	20
Final examination	60
Total	**100%**

Note that a student must normally receive a passing grade on the final examination to pass the course.

EXAMINATION: The final examination is of 3 hours' duration and is held in the regular examination period; it covers *all* the course material. A *handwritten* formula sheet, comprising not more than one side of 8½×11 inch paper, is permitted. Other aids for the final examination are a calculator and a *loose* copy of the normal table (*Text, pp. 330-331*).

(*continued overleaf*)

Outline Schedule

Lecture times are 11.30 a.m. on Monday, Wednesday and Friday, and the tutorial is at 4.30 p.m. on Wednesday. Term begins on Wednesday, January 4, 1989 and ends on Friday, March 31, 1989. The Mathematics Study Break is on Monday, February 20, and Tuesday, February 21; the Monday lecture is therefore lost in this week. A tentative schedule of course activities is given in the following table, although your instructor may vary this schedule to suit the needs of your particular lecture Section of the course; note the lecture-tutorial interchange in the week of January 4 (the *first* week of classes).

WEEK STARTING		TEXT SECTION(S)/ASSIGN. COVERED Lect. 1	Lect. 2	Tutorial	Lect. 3	ASSIGNMENT (Text Sections)		OTHER COURSE OBLIGATIONS
January	4	---	1.1,1.2	1.2,1.3	1.3,1.4	1	(up to 1.4)	---
	9	2.1	2.2	Ass. 01	2.3	2	(up to 2.3)	---
	16	3.1	3.2,3.3	Ass. 02	2.4,2.5	3	(up to 3.1)	---
	23	2.5,3.4	3.4,3.5	Ass. 03	3.6	4	(up to 3.5)	---
	30	4.1	4.1,4.2	Ass. 04	4.2	--	---	---
February	6	4.3	4.4	Spare	4.5	5	(up to 4.1)	Quiz #1 (up to Ass. 04)
	13	4.6	4.7	Ass. 05	5.1	6	(up to 4.4)	---
	20	---	5.2	Ass. 06	5.3	7	(up to 5.3)	---
	27	5.4	5.5	Ass. 07	6.1	--	---	---
March	6	6.1	6.2	Spare	6.2	8	(up to 6.1)	Quiz #2 (up to Ass. 07)
	13	6.6	6.6	Ass. 08	6.7	9	(up to 6.6)	---
	20	6.7,6.8	6.8	Ass. 09	Review	10	(up to 6.8)	---
	27	Review	Review	Ass. 10	Spare	--	---	---

Outline of Topics and Approximate Lecture Hours

TOPICS (Text Sections)	HOURS
Introduction; histograms, probability models (1.1 to 1.4)	3
Introductory combinatorial probabilities; random sampling; hypergeometric and binomial distributions (2.1 to 2.5)	4
Unions, intersections, complements; independence; conditional probability and Bayes' Theorem (3.1 to 3.6)	5
Discrete random variables; uniform, negative binomial and Poisson distributions; approximations (4.1 to 4.4)	5
Bivariate distributions; independence; multinomial distribution (4.5 to 4.7)	3
Expectations; mean, variance and standard form; moments; Chebyshev inequality; variance of a sum, covariance (5.1 to 5.5)	5
Continuous random variables; expectation; quantiles; change of variables via distribution function; uniform, exponential and normal distributions (6.1, 6.2, 6.6)	6
Central limit theorem; normal approximations, continuity corrections (6.7, 6.8)	3
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