Syllabus for
MAT 325—Probability and Statistics
3 Credit Hours
Spring 2001

I. COURSE DESCRIPTION

The basic theory of probability distributions, random variables, mathematical expectation, conditional probability, correlation, central limit theorem, sampling theory, interval estimation, and various statistical tests.
Prerequisite: MAT 321.
Computer use fee: $45.

II. COURSE GOALS

This course provides the student with a basic understanding of the theoretical foundations of probability and its applications in areas of statistics. The goals are essentially two-fold: to provide a useful tool in statistical analysis and to lay the groundwork for further study.

III. COURSE OBJECTIVES

As a result of successfully completing this course, the student will be able to do the following:

A. define the following basic concepts: sample space, event, independent events, equivalent events, probability, conditional probability, random variable, independent random variables, discrete random variable, continuous random variable, n-dimensional random variable, probability density function, joint probability density function, marginal probability density function, conditional probability density function, cumulative distribution function, expected value, conditional expectation, mean value, variance, standard deviation, correlation coefficient, moment generating function, statistic, population, and random sample.

B. differentiate between discrete and continuous random variables by giving examples and counter-examples.

C. write the probability density functions for random variables with the following distributions: uniform, binomial, exponential, gamma, chi-square, normal, Poisson, F-distribution, and t-distribution.

D. use expected value to obtain the mean and variance of a random variable with given distribution.

E. use the moment generating function to find the probability density function of arithmetic combinations of random variables with given distribution.

F. solve sample problems from those assigned as well as problems similar to those assigned.

G. use the probability tables in the appendix of the text.

H. state and apply the Central Limit Theorem.

I. solve sample problems from those assigned that illustrate statistical methods.

J. put confidence limits on means and variances.

K. be able to estimate parameters and make simple tests for hypotheses for means and variances.

L. solve the exercises and examples from the text and similar problems.

M. illustrate knowledge of terms by:
1. stating the definition.
2. stating whether an example is an example of the term.
3. using the term appropriately.

N. show knowledge of all theorems and techniques by:
1. stating the theorem or technique.
2. giving an example of an application of the theorem or technique.
3. applying the theorem or technique in appropriate situations. The situation may involve the use of one or more theorems or techniques.

III. TEXTBOOK

A. Required Textbook

Mendenhall, W., Scheaffer, R. and Wackerly, D. Mathematical Statistics With Applications. (5^{th} Ed.). Belmont, CA: Duxbury Press, 1996.

IV. POLICIES AND PROCEDURES

A. University Policies and Procedures
1. Attendance at each class or laboratory is mandatory at Oral Roberts University.
2. Double cuts will be assessed for absences immediately preceding or following holidays.
3. Excessive absences can reduce a student's grade or deny credit for the course.
4. Students taking a late exam because of an unauthorized absence will be charged a late exam fee.
5. Students and faculty at Oral Roberts University adhere to all laws addressing the ethical use of others' materials, whether it is in the form of print, video, multimedia, or computer software.
6. Final exams cannot be given before their scheduled times. Students need to check the final exam schedule before planning return flights or other events at the end of the semester.

B. Computer Science & Mathematics Department policies and Procedures
1. Each Student who uses the computer is given access to the appropriate computer resources. These limited resources and privileges are given to allow students to perform course assignments. Abuse of these privileges will result in their curtailment. Students should note that the contents of Computer directories are subject to review by instructors and the computer Administrative staff.
2. A fee of $10.00 will be assessed for all late exams. This policy applies to all exams taken without notifying the professor prior to the regularly scheduled exam time, and to all exams taken late without an administrative excuse.

C. Course Policies and Procedures

Evaluation Procedures

The standard grading scale is used, A (90% - 100%), B (80% - 89%), C (70%-9%), D (60-69%), F (0% - 59%). The composite score is determined by the following distribution:

Three fifty-minute exams @ 100 points	300 points	(50%)
Homework, computer labs and quizzes	150 points	(25%)
One final exam @ 150 points	150 points	(25%)

V. COURSE CALENDAR

LESSON	SECTION	TOPIC	HOMEWORK ASSIGNMENTS
1	Chap.1	Introduction	# 1, 2, 3, 5, 12
2	2.2	Probability and Inferences	
	2.3	Review of Set Notation	# 1, 3, 4, 6
	2.4	Discrete Probabilities	# 7, 8, 9, 11, 12
3	2.5	Sample-Point Method	# 15, 16, 17, 19
	2.6	Counting Tools	# 24, 25, 30, 36, 37, 39
4	2.7	Conditional Probabilities	# 47, 48, 49, 51
	2.8	Laws of Probabilities	# 59, 60, 61, 63, 66, 68
5	2.9	Event-Composition Method	# 70, 74, 75, 76, 80
	2.10	Bayes's Rule	# 83, 84, 85, 90, 91
6	2.11	Random Variables	# 95, 96, 97, 98
	2.12	Random Sampling	
	2.13	Summary	# 102, 105, 107, 108
7	3.2	Discrete Random Variables	# 2, 3, 4, 5, 9
	3.3	Expected Values	# 11, 13, 15, 20, 21
8	3.4	The Binomial Distribution	# 23,25,26,29,32,35,36,38,41
9	3.5	The Geometric Distribution	# 44, 45, 46, 48, 49
	3.7	The Hypergeometric Distribution	# 70, 74, 75, 76, 79
10	3.8	The Poisson Distribution	# 82, 83, 84, 88, 89
	3.9	Moment-Generating Functions	# 99, 101, 103, 105, 107
11	3.11	Tchebysheff's Theorem	# 113, 115, 117, 119, 121
	3.12	Summary	# 126, 131, 138, 147, 149
12	Review	Chapters 1,2 & 3	
13	Exam 1	Chapters 1, 2 & 3	

14	Evaluate	Review Exam	Various
15	4.2	Continuous Random Variables	# 2, 3, 6, 8, 9, 10
	4.3	Expected Values	# 12, 13, 14, 15
16	4.4	The Uniform Distribution	# 24, 25, 29, 30
	4.5	The Normal Distribution	# 34, 35, 38, 40, 46, 47
17	4.6	The Gamma Distribution	# 54, 58, 62, 66, 67
	4.7	The Beta Distribution	# 71, 74, 75, 77, 78
	4.8	Comments	
18	4.9	Other Expected Values	# 82, 84, 85, 86, 87
	4.10	Tchebysheff's Theorem	# 88, 93, 94, 95, 96
	4.12	Summary	
19	5.2	Multivariate Distributions	# 1, 2, 3, 4, 5, 6, 7, 8, 9, 10
20	5.3	Conditional Distributions	# 13, 15, 17, 20, 22
	5.4	Independent Random Variables	# 30, 32, 34, 37, 38
21	5.5	Expected Values	
	5.6	Special Theorems	# 44, 45, 46, 47, 48, 49, 50, 51
22	5.7	Covariance	# 55, 57, 58, 59, 60
	5.8	Variance	# 63, 65, 66, 68, 71
23	5.9	The Multinomial Distribution	# 75, 76, 79, 80, 81, 82
	5.10	The Bivariate Normal Distribution	# 84, 85
24	5.11	Conditional Expectation	# 87, 88, 92
	5.12	Summary	# 97, 99, 100, 101, 107
25	6.2	Probability Distributions	
	6.3	The Method of Distribution Functions	# 1, 2, 3, 4, 5, 6, 7, 8, 9, 10
26	6.4	The Method of Transformations	# 19, 20, 21, 24, 28
	6.5	The Method of Moment-Generating Functions	# 32, 33, 34, 39, 43
27	6.6	Order Statistics	# 47, 48, 49, 52, 55
	6.7	Summary	# 60, 63, 71, 74
28	Review	Chapters 4, 5 & 6	
29	Exam 2	Chapters 4, 5 & 6	
30	Evaluate	Review Exam	Various
31	7.2	Sampling Distributions	# 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

32	7.3	The Central Limit Theorem	# 19, 21, 247 27, 28
	7.5	Normal Approximation to the Binomial	# 35, 36, 37, 38, 42
	7.6	Summary	
33	8.2	The Bias of Point Estimators	# 1, 2, 4, 6, 7, 11, 13, 15
	8.3	Unbiased Point Estimators	
34	8.4	The Goodness of Point Estimators	# 19, 21, 24, 30, 32
	8.5	Confidence Intervals	# 35, 36, 37, 38, 39
35	8.6	Large-Sample Confidence Intervals	# 41, 43, 45, 47, 51
	8.7	Determining the Sample Size	# 56, 57, 58, 59, 62
36	8.8	Small-Sample Confidence Intervals	# 67, 69, 71, 74, 75
	8.9	Confidence Intervals for the Variance	# 79, 81, 83, 85, 87
	8.10	Summary	
37	9.2	The Relative Efficiency of Point Estimators	# 1, 3, 5, 6, 7
	9.3	The Consistency of Point Estimators	# 11, 13, 15, 21, 22
38	9.4	The Sufficiency of Point Estimators	# 25, 27, 29, 31, 33
	9.5	Minimum-Variance Unbiased Estimation	# 43, 45, 46, 47, 48
39	9.6	The Method of Moments	# 53, 55, 57, 59, 61
	9.7	The Method of Maximum Likelihood	# 65, 67, 69, 71, 73
40	Review	Chapters 7, 8 & 9	
41	Exam 3	Chapters 7, 8 & 9	
42	Evaluate	Review Exam	Various
43	10.2	Hypothesis Testing	# 1, 2, 3, 4
	10.3	Large-Sample Hypothesis Tests	# 5, 7, 9, 11, 13, 15
44	10.4	Type II Error Probabilities	# 25, 31, 32
	10.5	Hypothesis Testing & Confidence Intervals	# 33, 35, 37
	106	p-Values	# 39, 41, 43, 45
	10.7	Comments	
45	10.8	Tests of Hypotheses for Means	# 49, 51, 53, 55, 61
	10.9	Tests of Hypotheses for Variances	# 65, 67, 69, 71, 73

Dr. Roy Rakestraw
Name of Instructor

Math 325
Course No.

MISSION

The lifestyle at ORU is rooted in the word "Wholeness." ORU seeks to educate the whole person with balanced emphasis placed on the development of mind, spirit, and body.

GENERAL OUTCOMES

1. Spiritual Development
2. Physical Development
3. Communication
4. Analysis
5. Problem Solving
6. Valuing in Decision-making
7. Social Interaction
8. Global Perspectives
9. Effective Citizenship
10. Aesthetic Responsiveness
11. Knowledge Base

MAJOR OUTCOMES

Creative & Analytical Thinking/Communicating:
Demonstrates ability to think abstractly, discern patterns, recognize relationships and order ideas into a sequence of logical deductions. Effectively communicates his analyses to others in both symbolism and grammatically correct English.

Problem Solving Skills:
Demonstrates ability to read and analyze problems, construct and implement strategies for resolving problems and interpreting and verifying the resulting solutions.

Aesthetic Responsiveness:
Appreciates the origin of mathematical ideas, relationships between ideas, and processes for refining solutions, models, and methodologies.

Social Interaction:
Effectively learns teamwork while working with a group on open-ended multiple solution problems.

COURSE OUTCOMES

Analysis and Problem Solving:
Make valid assumption and approximations to simplify statistical problems
Apply classical solutions to general statistical problems

Value in Decision-making:
Understand the way in which assumptions affect the confidence level of solutions and decisions
Prescribe limits on the range of solutions

Knowledge Base:
Classical probability distributions
Difference between probability and statistics
Central limit theorem
Statistical inference
Confidence intervals

ASSESSMENT OF COURSE GOALS

Daily homework
Quizzes
Exams

CRITERIA:
The grades will be determined by applying the following weights and grading scale to the three examination scores, daily exercises scores, and final examination.

Exams 50%
Daily Exercises 25%
Final Exam 25%

A	90 – 100
B	80 -- 89
C	70 -- 79
D	60 -- 69