COURSE MANUAL-MAT 236, PROBABILITY

Course Information

Title: Probability
Code: MAT 236
Credits: 3
Entry Requirements: Students must take MAT 111 Algebra I and MAT 235 Calculus I

Instructor(s) Information

Name: Oray
Position: Lecturer
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Introduction:

Regardless of your career or job, you will occasionally have to make decisions, some of which have important implications. More often than not, you will have to make these decisions without knowing the full consequences of your actions. It is therefore important that all known risks involved be scientifically evaluated. Helpful in this evaluation is the concept of probability. Probability concepts allow us to make more reliable forecasts and predictions, even when we have only limited information. For this reason, probability has wide applications in all fields. This course introduces you to the basic language of probability theory and its concepts; and teaches yu how to calculate the probability that an event will occur. For this course to be more interesting to you, you need to revise your notes on algebra and calculus as they serve as the pre-requisite to the study of probability.

Subject content

The concept of probability theory; simple algebra of events; axioms of probability theory and their deductions; simple combinatorial analysis. Conditional probability and Baye's theorem. Notion of random variables; mathematical expectation and variance of random variables. Binomial, Poisson, Negative Binomial, Geometric and Hypergeometric distributions as examples of discrete random variables. The Normal, Uniform, Gamma and the Exponential distributions as examples of continuous probability distributions.

Connection with other courses:

This course serves as a pre-requisite to the following courses: MAT 242: Further Statistics, and

EDP 351 Research Methods

Learning objectives:

By the end of the course, students should be able to:

(i) Explain the intuitive meaning of probability theory
(ii) Apply counting techniques to solve problems in probability
(iii) Solve problems on conditional probability
(iv) Prove the formulae for total probability and solve problems on them
(v) Prove the formulae for Baye's theorem and solve problems on them
(vi) Distinguish between discrete and continuous random variables
(vii) Solve problems on discrete and continuous random variables
(viii) Find the mathematical expectation and variance of discrete and continuous random variables
(ix) Identify the various discrete probability distributions and solve problems involving them
(x) Identify the various continuous probability distributions and solve problems involving them

Literature and materials

Compulsory study texts:

(i) Asiedu-Addo, S., Awanta, K. & Amppiah; E. (2005); Fundamentals of Probability & Statistics with Computer Applications, (2nd Ed), City Printers, Accra.

Supplementary study texts:

(ii) Quading, D. (2000). Statistics & probability. Cambridge University Press, London
(iii) Walpole, E. R. and Myers, R. H. (2002). Probability and Statistics for Engineers and Scientists, Macmillan Publishing Co., New York
(iv) Any other relevant book on probability

Materials used:

(i) Scientific calculators
(ii) Computers
(iii) Note books

Course schedule

Week	Content Topics	Learning activities	Pre-Lesson Preparation
1	The concept of probability theory; sample spaces and events and examples on them.	In groups, students discuss and explain the concepts of sample space and events as applied in probability theory. Students to use the	Students review set theory and work through Examples 1.1, 1.2 and 1.3 of chapter 1 of course textbook.

		"URN problem" in graphic calculus to define the classical method of calculating probabilities of simple events.	
2	Counting techniques	Students to investigate the number of all possible outcomes of an event by constructing "Tree Diagrams" using the graphic calculus and to establish the multiplication rule of events. By the use of the spread sheet "EXCEL", students will determine the number of permutations and combinations there are in a given experiment.	Study section 1.3 of the main course textbook and work through Examples 1.5, 1.7, 1.9 and 1.13.
3	Algebra of events	Apply the fundamental concepts in set theory to construct probability theory based on the axiomatic approach. Students to work given problems on sums and products of events (Examples 1.16 and 1.17 of course textbook).	Review union, intersection, product and compliment of sets. Read pages 23– 29 of the main textbook and make deductions from the axioms of probability theory. Work examples 1.16 and 1.17.
4	Independence and conditional probability	Students work through examples 1.19, 1.20 and 1.21. Hands-on activity on Graphic Calculus to calculate the probability of independence of events and conditional probability.	Course text; Section 1.5 page 29 examples 1.19, 1.21 and 1.23
5	Total probability and Baye's theorem	Students use the multiplication rule to determine total probability leading to the establishment of the Baye's Theorem.	Study the derivation of the Total probability formula and the Baye's theorem in section 1.6 of the course textbook and work through examples 1.26 and 1.27.

	One hour quiz will be taken by all students taken this course after weeks 2-4 topics have been treated		
6	Discrete random variables and their numerical characteristics	Students will generate random numbers using the Graphic Calculus and the spread sheet EXCEL in groups. They will solve problems on mathematical expectation and variance of discrete random variables.	Study the properties of functions that can serve as probability distribution functions. Discuss the three main ways of presenting discrete probability distributions. (Read section 2.2 of the course textbook).
7	Continuous random variables and their numerical characteristics	Students will establish the fact that the probability that a random variable takes on a value in an interval is the area under the graph of the density function. There will be hands-on activity using the Graphic Calculus. Students to distinguish between density and distribution functions and solve problems on them.	Study section 2.4 and 2.5 Of the main course textbook and study examples 2.8, 2.10 and 2.12.
8	Binomial distribution	With the guide of the instructor, the properties of the Binomial distribution will be established and the mathematical expectation formula for Binomial distribution will be derived.	Work through examples 3.1, 3.2 and 3.3 of section 3.1 of the main course textbook.
	One hour quiz will be taken by all students taken this course after weeks 5-7 topics have been treated		
9	Poisson and distributions	Students will determine analytically the Poisson Approximation to the Binomial distribution. There will be Hands-on activity on the Binomial and the Poison distributions.	Read section 3.2 of the main textbook and take note of the properties of the Poison distribution. Work through the derivation oh the theorem in this section.

10	Negative Binomial and Geometric distributions	Students to establish the relationship between the Binomial and the Negative Binomial distributions. Solve problems on Nagative Binomial and the Geometric distributions.	Read sections 3.3 and 3.4 and work through examples 3.8, 3.9, 3,10 and 3,11.
11	Hypergeometric and the Normal distribution	Work problems concerning hypergeometric distributions. Students to explain in their own words the properties of the Normal curve as a continuous distribution. With the aid of Graphic Calculus, students find that every distribution (be it discrete or continuous) approaches the normal curve.	Work through examples 3.12 and 3.13 of course textbook. Study the properties of the Normal curve and work through examples 4.1 and 4.2.
12	The normal distribution (con't) and the Uniform distribution	In small groups students learn how to read the normal distribution table. Students solve problems on the Normal and the Uniform distributions.	Read section 4.1 and 4.2 and study examples 4.2, 4.4 and 4.5
13	Gamma and Exponential distributions	Students identify the real life applications of the Exponential and the Gamma functions and solve problems on their distributions.	Read sections 4.3 and 4.4 of the main course textbook and study the given examples.
	One hour quiz will be taken by all students taken this course after weeks 8-12 topics have been treated		
14	Overview of the semester's work.	Students to review the course content and solve problems of interest.	Revision

ASSIGNMENTS:

All assignments are taken from the course book**:** Asiedu-Addo, S., Awanta, K. &

Amppiah; E. (2006); Elements of Ordinary Differential Equations, (Revised Ed), City Printers, Accra. **Assignments and tutorial presentations are due as given above. Late work is unacceptable**.

MODE OF ASSESSMENT

Attendance and class contribution	5%
Assignments (group or individual)	10%
Quizzes	25%
Final Exam	60%

Grading Policies:

A = 80-100, **B+** = 75-79, **B** = 70-74, **C+** = 65-69, **C** = 60-64, **D+** = 55-59, **D** = 50-54, Below 50 = **E**

COURSE POLICIES:

Any violation of the university rules relating to courses will result in a failing grade on the assignment and possible university disciplinary action.

CODE OF CONDUCT:

- Attendance and active participation are **required** in this class. You are expected to read all the assigned material before class and attend every class session fully prepared to participate in discussions and activities. Lateness to lectures will not be entertained.
- Do assigned homework on time, show eagerness, aggressiveness and enthusiasm towards the course
- Switch off cell phones before entering the lecture theater
- Be courteous and considerate to your other classmates and to the lecturer. Harassment in any form will not be tolerated.
- Students with disabilities will be appropriately accommodated. Please let me know at the beginning of the semester if you need particular accommodations.
- Mathematics is a cumulative subject. Do not expect to understand subsequent material if you have not mastered current material

DRESS CODE:

- Men Decent Trousers (preferably dark), white shirt and tie.
- Women Decent Trousers or skirt (preferably dark), white shirt and tie or morfla.

PLAGIARISM:

Plagiarized work will receive a score of zero on the assignments. Plagiarism may also warrant a failing grade in the course and /or university disciplinary action.