**United Arab Emirates University**                    **College of Business and Economics**
**Department of Analytics in the Digital Era**
**Course Syllabus**
**Spring 2023**

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| **Course No.:** | STAT230 | **Instructor:** | Ibrahim Alfaki |
| **Course Title:** | Principles of Probability | **Office Hours:** | UT 1:00-2:00PM (Males) |
| | | | UT 2:00-3:00PM (Females) |
| **Prerequisites:** | GBUS135 (Quant. Meth. Busn.) | **Office phone:** | 03-713-5253 |
| **Time and Location:** | UT 10:00-11:15 | **Email:** | i.abdalla@uaeu.ac.ae |

## Course Objectives:

1. Have a thorough understanding of the concepts of probability and its basic properties and laws.

2. Be able to use a variety of counting techniques to compute probabilities.

3. Have an understanding of conditional probability and be able to compute posterior probabilities.

4. Know how to use random variables and work with their distributions in modeling applied problems.

5. Be able to compute unconditional and conditional expectations, including moments and moment generating functions.

## Course Description:

This course is an introduction to the principles and laws of probability. It is aimed at giving the student a thorough understanding of the concepts of probability, random variables, distributions and expected value. Although the primary focus of the course is on a mathematical development of the subject, it also includes a variety of illustrative examples and exercises that are oriented towards applications in the social and physical sciences.

## Textbook:
A First Course in Probability, 8th edition, by Sheldon Ross.
## References:

1. Online textbook in course homepage: Introduction to Probability, by Grinstead, M. C. and Snell, J. L.
2. Mathematical Statistics, 7th edition, by Wackerly, Mendenhall and Scheaffer.
3. An Introduction to Mathematical Statistics and its Applications, 2nd edition, by R. J. Larsen and M. L. Marx.
4. Introduction to Mathematical Statistics, 4th edition, by Hogg, R. V. and Craig, A. T.

## Teaching Methods:
1. Explaining concepts and applications through mini-lectures using laptop and Blackboard Collaborate Ultra.
2. Visual illustration of statistical concepts using videos and JAVA applets.
3. Solving on-line and off-line practice problems with group discussions.
4. WWW links to relevant course material.
5. Assignments.

## Use of Modern Instructional Technology:
1. PowerPoint Presentations
2. Blackboard course management system.

3. World Wide Web.
4. Mathemaical package (Derive) and Statistical package (Minitab).

## Skills To Be Developed:
1. Oral and written communication skills through class discussions and presentations.
2. Analytical skills through solving problems.
3. Team work skills through class discussions, homework assignments.
4. Creativity through the various homework assignments.
5. Adaptability to change through exam questions, homework assignments.

## Grading Policy:

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| Final Exam (--/--/ ------) | 40% |
| Midterm Exam (--/--/-----) | 20% |
| Assignments | 15% |
| Quizzes | 20% |
| In-class problem solving and discussion | 5% |

## Policies:
1. Exams are based on all the materials covered and assigned in the classroom and in the homework assignments. So students are strongly advised to attend all the lectures and to be on time.
2. Anyone who misses an exam/ or a Quiz will receive an F (0%) for that exam/ or that Quiz. **Make-up exams/quizzes will not be given.**
3. There will be five homework assignments; the best four will be counted. When collected, homework is due at the beginning of class. All computer output must be edited and annotated. **Late homework will not be accepted.**
4. There will be five quizzes; the best four will be counted. The quizzes are closed-book but a formula sheet is allowed.
5. The Following Statement is required by the University: *The United Arab Emirates University is committed to creating a learning environment that is honest and ethical. Academic dishonesty will not be tolerated at the UAE University. Academic dishonesty includes cheating, plagiarism or any other attempt to gain an academic advantage in a dishonest or unfair manner.*
6. **Note:** The course outline is subject to possible changes. In case of any possible changes you will be notified in advance.

## Course contents:

| **Unit No.** 1 | **Unit Title :** Set Theory | **No. of Hours:** 3 hours |

**Unit contents:** Basic concepts, the Venn diagram, set operations, laws of set operations (Lecture Notes & Web Homepage).

**Unit Objectives:** Review the necessary background for working with sets graphically through the Venn diagram and analytically trough set operations.

**Teaching Methods:** Independent readings and problem solving.

**Educational Resources:**. Section 2.2.

**Learning Activities:** Solve Pbs. 3, 5, 7, 9, 11 in the notes.


| **Unit No.** 2 | **Unit Title :** Counting techniques | **No. of Hours:** 6 hours |

**Unit contents:** Introduction, combinatorial methods. Sections 1.1 - 1.2.

**Unit Objectives:**

1. Know various counting techniques.

2. Apply counting techniques to compute probabilities of events.

**Teaching Methods:** Lectures, exercise sessions, self-study through the course homepage.

**Educational Resources:** Required textbook: Sections 1.2-1.4; recommended reference No. 1: Chapter 3; course homepage.

**Learning Activities:** Exercise session; handout; homework assignments, and problems in the notes.


| **Unit No.** 3 | **Unit Title :** Definition and properties of probability | **No. of Hours:** 6 hours |

**Unit contents:** Introduction, sample space, events, operations on events, axioms of probability, rules of probability.

**Unit Objectives:**

1. Understand the basic concepts of a random experiment.

2. Know the axioms and properties of probability.

3. Compute the probability of an event.

**Teaching Methods:** Lectures, exercise sessions, self-study through the course homepage.

**Educational Resources:** Required textbook: Sections 2.3 – 2.5; recommended reference No. 3: Sections 2.1, 2.2, 2.4 - 2.6; course homepage.

**Learning Activities:** Exercise session; handout; homework assignments, and self-study through the course homepage.


| **Unit No.** 4 | **Unit Title :** Conditional probability and independence | **No. of Hours:** 4.5 hours |

**Unit contents:** Definition and properties of conditional probabilities, law of total probability, Bayes Theorem, independence of events.

**Unit Objectives:**

1. Understand the basic concepts of conditional probability.

2. Know the properties of conditional probability.

3. Compute posterior distributions.

**Teaching Methods:** Lectures, exercise sessions, self-study through the course homepage.

**Educational Resources:** Required textbook: Sections 3.1 – 3.4; recommended reference No. 1: Chapter 4; course homepage.

**Learning Activities:** Exercise session; handout; homework assignments; self-study through the course homepage.

**Unit No.** 5        ***Unit Title :*** Random variables and expectations        ***No. of Hours:*** 15 hours

***Unit contents:*** Review of integration methods, discrete and continuous random variables, distributions of a random variable, mean, variance, expectation of a function of a random variable, moments, moment-generating functions.

***Unit Objectives:***
1. Distinguish between discrete and continuous random variables.
2. Know the properties of probability distributions, densities and cumulative distribution functions.
3. Compute the distribution of a random variable.
4. Compute the mean and variance of a random variable.
5. Compute the mean of a function of a random variable.
6. Use moment-generating functions to compute the moments of a random variable.

***Teaching Methods:*** Lectures, exercise sessions, self-study through the course homepage.

***Educational Resources:*** Required textbook: Sections 4.1 – 4.3, 4.5 and 5.1-5.5; recommended reference No. 1: chapters 5 and 6; course homepage.

***Learning Activities:*** Exercise session; handout; homework assignments; self-study through the course homepage.


**Unit No.** 6        ***Unit Title :*** Bivariate distributions        ***No. of Hours:*** 13.5 hours

***Unit contents:*** Bivariate vectors, joint distributions, marginal distributions, conditional distributions, independence, covariance, conditional expectations.

***Unit Objectives:***
1. Compute joint, marginal and conditional distributions.
2. Compute joint distributions of two random variables.
3. Check the independence of random variables.
4. Compute covariances and conditional expectations.

***Teaching Methods:*** Lectures, exercise sessions, self-study through the course homepage.

***Educational Resources:*** Required textbook: Sections 6.1-6.2 and 6.4-6.5; recommended reference No. 2: Sections 5.1 – 5.8, 5.11; course homepage.

***Learning Activities:*** Exercise session; handout; homework assignments; self-study through the course homepage.