****

**Department of Statistic**

**University of Salahddin University - Erbil**

**Subject: Probability Theory**

**Course Book – (2nd Year)**

Lecturer's name: Dr.Awat Sirdar Wahdi

**Academic Year: 2022/2023**

**Course Book**

|  |  |  |
| --- | --- | --- |
| **1. Course name** | **Probability Theory** | |
| **2. Lecturer in charge** | Dr.Awat Sirdar Wahdi | |
| **3. Department/ College** | **Statistic / Administration & Economic** | |
| **4. Contact** | **e-mail:** / | |
| **5. Time (in hours) per week** | **Theory: 2**  **Practical: 1** | |
| **6. Office hours** | **Availability of the lecturer to the student during the week** | |
| **7. Course code** |  | |
| **8. Teacher's academic profile** | I have earned a Degree of Doctor of Philosophy in Statistics  from Statistics Department – University of Baghdad  College of Administration & Economic. I have been teaching in Statistics department at Salahaddin University since 2007. I have taught the following subject: Statistics, the computer, Mathematics, linear algebra, Calculus, Operations Research. | |
| **9. Keywords** | **Probability & Distribution, Elementary of Statistics, Central Tendency, Dispersion, Correlation, Regression and Survival analysis.** | |
| **10. Course overview:**  Probability is the most important conception modern science, especially as nobody has the slightest notion what it means. Most people have some vague idea about what probability of an event means. The interpretation of the word probability involves  Synonyms such as chance, odds, uncertainty, prevalence, risk, expectancy etc. There are many distinct interpretations of the word probability. A completed is cuss ion of these interpretations will take us to areas such as philosophy, theory of algorithm and randomness, religion, etc. Thus, we will only focus on two extreme interpretations. One interpretation due to the so-called objective school and the other is due to the subjective school.  Probability theory provides a mathematical foundation to concepts such as “proba-bility”, “information”, “belief”, “uncertainty”, “conﬁdence”, “randomness”, “vari-  Ability”, “chance” and “risk”. Probability theory is important to empirical sci-  entists because it gives them a rational framework to make inferences and test  hypotheses based on uncertain empirical data. Probability theory is also useful  to engineers building systems that have to operate intelligently in an uncertain  world. For example, some of the most successful approaches in machine per-  ception (e.g., automatic speech recognition, computer vision) and artiﬁcial intel-  ligence are based on probabilistic models. Moreover probability theory is also  proving very valuable as a theoretical framework for scientists trying to under-  Stand how the brain works. Many computational neuroscientists think of the brain  as a probabilistic computer built with unreliable components, i.e., neurons, and  use probability theory as a guiding framework to understand the principles of  computation used by the brain. | | |
| **11. Course objective:**  The general purpose of this course is to study the basic concepts of Probability in order to help students understand the value of Probability in acquiring knowledge, so that preparing them with in-depth learning probability, some statistical methods. After taking this course, students will be able to use basic Probability, including techniques of counting, conditional probability, solve mathematical statistics and some distributions, solve probabilistic problems and they will be prepared studying statistical subjects in the 3rd and 4th academic classes. Topics include set theory and techniques of counting and definition of probability, classical probability, conditional of probability and independence, Bayes theorem, random variables, Expectation and variance of random variables, joint and marginal probability distribution, Binomial distribution, Normal distribution, Poisson distribution, with some additional topics that will be identified as the course progress. | | |
| **12. Student's obligation**  Students are expected to:   * Follow university policies when attending class and lab, and taking quizzes and exams. * Bring stationery to class. * Bring scientific calculator to class. * Be on time to class!   Student should be proud of the work that he/she do in this class. Do not allow someone else to copy your homework and do not provide answers to quizzes or tests. If this does occur, credit will be lost and a referral will be written | | |
| **13. Forms of teaching**  A course with a large proportion of its teaching taking place in lectures will need to have a high level of essential interest to students to keep them engaged. There are lots of talks about what is good teaching technique in academic circle, they often come out with different forms such as: classical teaching with blackboard, power point presentations for the head titles and definitions and summary of conclusions, classification of materials and any other illustrations, students will be asked to prepare reports on statistical topics and they should participate asmuch as possible in lecture’s discussions. Also, it is useful to fulfill some seminars by students to encouraging them learning and discussing the subject without lecturer. | | |
| **14. Assessment scheme**  The students are obliged to perform at least two closed book exams during the academic year (2018/2019). The exam has 20%, besides homework and classroom activities – 6%, quizzes – 4%. The other 60% will be reserved for the final exam. Therefore, the final grade will be based upon the following criteria:  Homework and interactive activities: 10%  Exams: 30%  Final Exam: 60% | | |
| **15. Student learning outcome:**  During the study period of BSc, there will be good opportunities for students who had this course to engage in part time works in many companies and organizations as data collectors, data entries, data presenters and analysers. Therefore, it is very important to have all the subjects which are pretended to take in this course. In another hand, without taking this course, students could not have good understanding for the subjects of the next years.  Students will have good knowledge about the Probability distribution and how to merge between statistical methods and real life. In other words, Students can do something with any data that they receive it. | | |
| **16. Course Reading List and References‌:**  **1-** Seymour, Lipschutz., Theory and problems of Probability(Schaum's Outline), McGraw-Hill Inc.1974.  **2-** Tebbs, Joshua M., Introductory probability and statistics I, 1st ed.,2004.  **3-** Bluman, Allan G., Elementary Statistics (A step by step approach), McGraw-Hill Pub., 8th ed.,  2012.  4- Gupta,Parmanand., Business Statistics, 3rd ed., 2008.  5- Mejlbro, Lief., Introduction to Probability( Probability Examples c-1),ventus publishing  APS.,2009.  6- Brink , David., Essentials of Statistics (Exercises),ventus publishing APS.,2009. | | |
| **17. The Topics:** | | **Lecturer's name** |
| \*Conditional Probability, Multiplication Rule, Bayes Theorem.  Independence.  \*Definition, types of random variables (Discrete and Continuous), The probability density function (p.d.f) for Discrete r.v, Cumulative distribution function (c.d.f) for Discrete r.v, The probability density function (p.d.f) for Continuous r.v, Cumulative distribution function (c.d.f) for Continuous r.v, Mathematical Expectation of the random variables, Variance of Random variables, Moments Generating function (m.g.f) of the random variables, Joint Probability Distribution Function (J.p.d.f), Marginal Probability Distribution Function (m.p.d.f).  \*Binomial Distribution, Poisson Distribution, Normal Distribution. | | Dr.Awat Sirdar Wahdi (2hrs) |
| **18. Practical Topics (If there is any)** | | **Lecturer's name** |
| For practical lessons, Students will be practicing all the topics that  have been taught in theory lessons. | | Awat Sirdar Wahdi (1hrs) |
| **19. Examinations:**  ***1. Compositional:***The following are some examples related to compositional questions:  1- Tickets numbered 1 to 20 are mixed up and then a ticket is drawn at random. What is the probability that the ticket drawn has a number which is a multiple of 3 or 5?  2-A bag contains 2 red, 3 green and 2 blue balls. Two balls are drawn at random. What is the probability that none of the balls drawn is blue?  3- In a box, there are 8 red, 7 blue and 6 green balls. One ball is picked up randomly. What is the probability that it is neither red nor green?  4-Three unbiased coins are tossed. What is the probability of getting at most two heads?  5-What is the probability of getting a sum 9 from two throws of a dice?  6-Two dice are thrown simultaneously. What is the probability of getting two numbers whose product is even?  7-In a class, there are 15 boys and 10 girls. Three students are selected at random.The probability that 1 girl and 2 boys are selected?  8-In a lottery, there are 10 prizes and 25 blanks. A lottery is drawn at random. What is the probability of getting a prize?  9-Two dice are tossed. The probability that the total score is a prime number?  10-A card is drawn from a pack of 52 cards.The probability of getting a queen of club or a king of heart?  11-A bag contains 4 white, 5 red and 6 blue balls. Three balls are drawn at random from the bag. The probability that all of them are red?  12-Two cards are drawn together from a pack of 52 cards. The probability that one is a spade and one is a heart?  13- What is the probability of selecting a test subject who received a negative test  result or lied? Use the chart below:   |  |  |  | | --- | --- | --- | |  | **Subject did not lie** | **Subject lied** | | **Positive Test Result (Test indicated subject lied)** | **13** | **74** | | **Negative Test Result (Test indicated subject did not lie)** | **68** | **6** |   14- If a classroom contains 5 students, what is the probability that at least two of  them have the same birthday? We are given two urns as follows:  15- Urn A contains **5** red and **3** white balls.  Urn B contains **2** red and **4** white balls.  An urn is selected at random, a ball is drawn and put into the other urn, and then a ball is drawn from the second urn. Find the probability that both balls drawn are of the same colour.  **16- Urn A** contains **6** red marbles and **4** blue marbles, and **urn B** contains **3** red marbles and **5** blue marbles. **(1)** If a marble is drawn from each urn, what is the probability that they are both of the same colours? **(2)** If two marbles are drawn from each urn, what is the probability that all four marbles are of the same colour?  17- In a certain town, 50% of the people has black hair, **20%** have black eyes, and **10%** have both black hair and black eyes. A person is selected at random from the town.  **(1)**If he has black hair, what is the probability that he also has black eyes?  **(2)** If he has black eyes, what is the probability that he doesn’t have black hair?**(3)** what is the probability that he has neither black eyes and black hair.  18- A class have 9 boys and 5 girls. Three students are selected from the class at random, without replacement. Find the probability that:  **(1)**The first two are boys and third is girl? **(2)**The first and third are boys and the second is girl? **(3)**The first and third are of the same sex , and the second is of the opposite sex?  19- A husband and a wife appear in an interview for two vacancies for the same post. The probability of husband’s selection is (3/5) and that of wife’s selection is (1/5). Find the probability that: **(1)** Both are selected? **(2)** Exactly one is selected?**(3)** None is selected?  20- A class consist of 100 students. Out of these are 25 are girls and 75 are boys.10 of them are rich, remaining poor. Out of 100, only 20 students are fair complexioned. What is the probability of selecting a fair complexioned rich girl?  21- A manufacturing firm produce steel pipes in three plants (20, 30, 50) with daily production that the fraction of defective outputs produced by three plants respectively 0.005, 0.008, 0.010. If a pipe is selected from a day’s total production and found to be defective, find out the probability that it came from the first plant?  22- An insurance company insured 2000 scooter drivers, 4000 car drivers and truck drivers. The probability of an accident involving a scooter driver, car driver and a truck driver is (0.01, 0.03 and 0.15) respectively. One of the insured drivers meets with an accident. What is the probability that he is a car driver?  23- A and B are events associated with a random experiment such that P(A)=1/3 , P(B)=1/4 , p(AB)=1/5 , find:  (1) P(A|B) ? (2) P(B|A) ? (3) P(AUB) ? (4) P(| ) ? (5) P(|) ?  24- In a certain college, 25% of the boys and 10% of the girls are studying mathematics. The girls constitute 60% of the student. If a student is selected at random and is studying mathematics, determine the probability that the student is a girl?  25- Approximately 1% of woman aged (40 - 50) has breast cancer. A woman with breast cancer has a 90% chance of a positive test from a mammogram ,with a woman without has 10% chance of a false positive result. What is the probability a woman has breast cancer given that she just had a positive test? | | |
| **20. Extra notes:**  Nothing | | |
| **21. Peer review** | | |