

**UNITY UNIVERSITY ADAMA SPECIAL CAMPUS**  
**COMPUER SCIENCE DEPARTMENT**

**Introduction to Statistics Worksheet II (CHAPTER 5-9)**

1. Four married couples have bought 8 seats in a row for a show. In how many different ways can they be seated
  - a. If each couple is to sit together?
  - b. If all the women sit together?
  - c. If all the women sit together to the right of all the men?
2. If a multiple choice test consists of 4 questions each with 4 possible answers of which one is correct
  - a. In how many different ways can a student check off one answer to each question?
  - b. In how many different ways can a student check off one answer for each question and get all the questions wrong?
3. Four men and three women are to be seated at a lunch counter that has only five stools.
  - a. In how many ways can the customers be arranged at the counter?
  - b. In how many ways can they be arranged at the counter if all the women are to be seated?
  - c. In how many ways can they be arranged at the counter if all the women are to be seated and if men occupy the first and last stool?
  - d. If customers take seats at random, what is the probability that all of the men are seated and that a woman occupies the middle stool?
4. One bag contains 4 white balls and 3 black balls, and the second bag contains 3 white balls and 5 black balls. One ball is drawn at random from the second bag and placed unseen in the first bag. What is the probability that a ball now drawn from the first bag is white?
5. A lot consists of 20 defective and 80 non-defective items from which two items are chosen without replacement. Events A & B are defined as  $A = \{\text{the first item chosen is defective}\}$ ,  $B = \{\text{the second item chosen is defective}\}$ 
  - a. What is the probability that both items are defective?
  - b. What is the probability that the second item is defective?

6. Let A and B be two events associated with an experiment and suppose that  $P(A)=0.4$  while  $P(A \cup B)=0.7$ . Let  $P(B)=P$
- For what choice of P are A and B mutually exclusive?
  - For what choice of P are A and B independent?

7. The personnel department of a company has records which show the following Analysis of its 200 accountants.

Age	Bachelor's degree only	Master's degree
Under 30	90	10
30 to 40	20	30
Over 40	40	10

If one accountant is selected at random from the company, find

- The probability he has only a bachelor's degree.
  - The probability he has a master's degree, given that he is over 40.
  - The probability he is under 30, given that he has a bachelor's degree.
8. Two dice are rolled. Let X is a random variable denoting the sum of the numbers on the two dice.
- Give the probability distribution of X
  - Compute the expected value of X and its variance
9. State the conditions (assumptions) under which random variable can have a binomial distribution.
10. The probability that a freshman entering AAU (Science Faculty) will survive first semester is 0.92. (From 1993/94 academic year statistics). Assuming this pattern remain unchanged over the subsequent years, what is the probability that among 100 randomly selected freshmen in first semester,
- None will survive?
  - Exactly 97 will survive?
  - At least three will survive?
11. An allergist claims that 50% of the patients she tests are allergic to some type of weed. What is the probability that
- Exactly 3 of her next 4 patients are allergic to weeds?
  - None of her next 4 patients are allergic to weeds?

- 12.** A multiple-choice test consists of six questions and three choices to each question (of which only one is correct). If a student answers each question by rolling a balanced die and checking the first answer if he gets a 1 or a 2, the second answer if he gets a 3 or a 4, and the third answer if he gets a 5 or a 6, find the probabilities of getting
- Exactly three answers
  - No correct answers
  - At least five correct answers.
- 13.** A secretary makes 2 errors per page on the average. What is the probability that on the next page she makes
- 4 or more errors?
  - No errors?
- 14.** It is known that bacteria of a certain kind occur in water at a rate 2 bacteria per cubic centimeter of water. Assuming that the phenomenon obeys a Poisson probability law, what is the probability that a sample of two cube centimeters of water will contain
- No bacteria?
  - At least one bacterium?
- 15.** The scores for a mathematics course seems to be normally distributed with mean 70 & standard deviation of 8. If the instructor wishes to give an A grade to 10% of the students, what should be the dividing line between an A grade and a B grade?
- 16.** Of a large group of men, 5% are less than 60 inches in height and 40% are between 60 & 65 inches. Assuming a normal distribution, find the mean and standard deviation of heights.
- 17.;**
- A normal distribution has mean  $\mu = 62.4$ . Find its standard deviation if 20% of the area under the curve lies to the right of 79.2
  - A random variable X has normal distribution with standard deviation  $\sigma = 5$ . Find its mean if the probability is 0.8264 that the random variable will take on a value less than 52.5.
  - Show that 65.24% of the observations in a normally distributed population lie between  $\mu - 1.1\sigma$  and  $\mu + 0.8\sigma$ .

- 18.** If a set of marks on a statistics examination are approximately normally distributed with a mean of 74 and a standard deviation of 7.9, find
- The lowest passing mark if the lowest 10% of the students are given F's
  - The lowest mark to get grade A if the top 5% of the students are given A's
  - The lowest mark to get grade B if the top 10% of the students are given A's and the next 25 % are given B's
- 19.** The mean of the inner diameters (in inches) of a sample of 200 tubes produced by a machine is 0.502 and s.d. is 0.005. The purpose for which these tubes are intended allows a maximum tolerance in the diameter of 0.496 to 0.508 (i.e. otherwise the tubes are considered defectives). What percentage of the tubes produced by the machine is defective if the diameters are found to be normally distributed?
- 20.** The grade point average for all freshmen at a university has a standard deviation of 0.50.
- A random sample of 20 students is to be used to estimate the population means grade point average. What assumption is necessary in order to compute the probability of obtaining a sample mean within  $\pm 0.2$  of the population mean?
  - Provided that this assumption can be made, what is the probability of  $\bar{X}$  being within  $\pm 0.2$  of the population mean?
  - If this assumption cannot be made, what would you recommend doing?
- 21.** If the uric acid values in normal adult males are approximately normally distributed with mean 5.7 mgs and standard deviation 1mg find the probability that a sample of size 9 will yield a mean.
- greater than 6
  - between 5 and 6
  - less than 5.2
- 22.** An electrical firm manufactures light bulbs that have a length of life that is approximately normally distributed with a standard deviation of 40 hours. If a random sample of 30 bulbs has an average life of 780 hours, find a 99% confidence interval for the population mean of all bulbs produced by this firm.

- 23.** A random sample of 400 households was drawn from a town and a survey generated data on weekly earning. The mean in the sample was Birr 250 with a standard deviation Birr 80. Construct a 95% confidence interval for the population mean earning.
- 24.** A major truck has kept extensive records on various transactions with its customers. If a random sample of 16 of these records shows average sales of 290 liters of diesel fuel with a standard deviation of 12 liters, construct a 95% confidence interval for the mean of the population sampled.
- 25.** Capacitors are manufactured on a production line. It is known that their capacitances have a coefficient of variation of 2.3%.
- What is the probability that the capacitance of a capacitor will be between  $0.990\mu$  and  $1.010\mu$  if  $\mu$  is the mean capacitance of the population? State any assumption.
  - We want to make the 99% confidence interval for the sample mean of the capacitances to be no larger than from  $0.990\mu$  to  $1.010\mu$ , where  $\mu$  is the population mean. What is the minimum sample size?
- 26.** A company received 200 electrical components that were claimed to have a mean life of 500 hours. Assume the distribution of component lives was normal. A sample of 25 components was selected randomly without replacement. It was decided to give that sample a special test that would allow the component life to be estimated accurately but nondestructively.
- What is the maximum value the standard deviation of the population could have if the sample mean was to be within  $\pm 10\%$  of the population mean with a 95% confidence level?
  - If the coefficient of variation of the population was 2% and the sample mean was found to be 487.0 hours, what conclusions can be made about the claims of the manufacturer? Use the 5% level of significance.
- 27.** Two companies produce resistors with a nominal resistance of 4000 ohms. Resistors from company A give a sample of size 9 with sample mean 4025 ohms and estimated standard deviation 42.6 ohms. A shipment from company B gives a sample of size 13 with sample mean 3980 ohms and estimated standard deviation 30.6 ohms. Resistances are approximately normally distributed.
- At 5% level of significance, is there a difference in the mean values of the resistors produced by the two companies?
  - Is either shipment significantly different from the nominal resistance of 4000 ohms? Use .05 level of significance.