

Assignment-3

Math 361

1. Tay-Sachs is a rare genetic disease that results in a fatty substance called ganglioside G_{M2} building up in the tissues and nerve cells in the brain, eventually leading to death. The disease is recessive. If a person inherits a gene for Tay-Sachs from one parent but not the other, then he or she shows no signs of the disease but could pass the gene to an offspring. Thus a person who is heterozygote with a Tay-Sachs gene is called a carrier for Tay-Sachs. Suppose two people who are carriers for Tay-Sachs wed and have children.

(a) What is the probability that a child of these two people will neither have the disease nor be a carrier?

(b) If the couple has five children, what is the probability that none will have the disease or be a carrier?

2. A large food company relies on taste panels to decide whether to go forward with a proposed new product. A taste panel consists of 10 people who are tested independently of one another. Each person is presented with the new product and the standard for that product. They are asked to identify the one they prefer. The company moves forward with the new product if 80% or more of the panel prefer it. Unknown to the company, for the new product under consideration, 30% of all people cannot tell the difference between the two and so will randomly choose one of them. Of the remaining people, 90% prefer the new product. What is the probability that the company will move forward with the new product?

3. Each day a large animal clinic schedules 10 horses to be tested for a common respiratory disease. The cost of each test is \$80. The probability of a horse having the disease is 0.1. If the horse has the disease, treatment costs \$500.

(a) What is the probability that at least one horse will be diagnosed with the disease on a randomly selected day?

(b) What is the expected daily revenue that the clinic earns from testing horses for the disease and treating those that are sick?

(c) What is the variance of the daily revenue that the clinic earns from testing horses for the disease and treating those that are sick?

4. Six lightbulb, 2 of which are defect are being mixed. Two of the lightbulb are randomly selected. Let X denote the number of defective lightbulb picked.

(A) Determine the probability mass function for X .

(B) Determine the Cumulative Distribution function for X .

(Problem 1,2, and 3 are from the book: Introduction to probability and its application by R. Scheaffer and L. Young)