

Discrete Distribution Practice

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STATS 67 - UCI

Example: The 2010 American Community Survey estimates that 47.1% of women ages 15 years and over are married.

- a. We randomly select three women between these ages. What is the probability that the third woman selected is the only one who is married?

- b. What is the probability that all three randomly selected women are married?

- c. On average, how many women would you expect to sample before selecting a married woman? What is the standard deviation?

- d. If the proportion of married women was actually 30%, how many women would you expect to sample before selecting a married woman? What is the standard deviation?

- e. Based on your answers to parts (c) and (d), how does decreasing the probability of an event affect the mean and standard deviation of the wait time until success?

Example: A machine that produces a special type of transistor (a component of computers) has a 3% defective rate. The production is considered a random process where each transistor is independent of the others.

- a. What is the probability that the 10th transistor produced is the first with a defect?

- b. What is the probability that the machine produces no defective transistors in a batch of 100?

- c. On average, how many transistors would you expect to be produced before the first with a defect? What is the standard deviation?

- d. Another machine that also produces transistors has a 5% defective rate where each transistor is produced independent of the others. On average how many transistors would you expect to be produced with this machine before the first with a defect? What is the standard deviation?

- e. Based on your answers to parts (c) and (d), how does increasing the probability of an event affect the mean and standard deviation of the wait time until success?

Example: Sickle cell anemia is a genetic blood disorder where red blood cells lose their flexibility and assume an abnormal, rigid, "sickle" shape, which results in a risk of various complications. If both parents are carriers of the disease, then a child has a 25% chance of having the disease, 50% chance of being a carrier, and 25% chance of neither having the disease nor being a carrier. If two parents who are carriers of the disease have 3 children, what is the probability that

- a. two will have the disease?
- b. none will have the disease?
- c. at least one will neither have the disease nor be a carrier?
- d. the first child with the disease will be the 3rd child?

Example: A coffee shop serves an average of 75 customers per hour during the morning rush.

- a. Which distribution we have studied is most appropriate for calculating the probability of a given number of customers arriving within one hour during this time of day?
- b. What are the mean and the standard deviation of the number of customers this coffee shop serves in one hour during this time of day?
- c. Would it be considered unusually low if only 60 customers showed up to this coffee shop in one hour during this time of day?
- d. Calculate the probability that this coffee shop serves 70 customers in one hour during this time of day?

Ex: A very skilled court stenographer makes one typographical error (typo) per hour on average.

- a. What probability distribution is most appropriate for calculating the probability of a given number of typos this stenographer makes in an hour?

- b. What are the mean and the standard deviation of the number of typos this stenographer makes?

- c. Would it be considered unusual if this stenographer made 4 typos in a given hour?

- d. Calculate the probability that this stenographer makes at most 2 typos in a given hour.

Ex: A 2005 Gallup Poll found that 7% of teenagers (ages 13 to 17) suffer from arachnophobia and are extremely afraid of spiders. At a summer camp there are 10 teenagers sleeping in each tent. Assume that these 10 teenagers are independent of each other.

- a. Calculate the probability that at least one of them suffers from arachnophobia.

- b. Calculate the probability that exactly 2 of them suffer from arachnophobia.

- c. Calculate the probability that at most 1 of them suffers from arachnophobia.