

Ch 6 Review

Name _____

1. A company sells concrete in batches of 5 cubic yards. The probability distribution of X , the number of cubic yards sold in a single order for concrete from this company, is shown in the table below.

X = the number of cubic yards	10	15	20	25	30
Probability	0.15	0.25	0.25	0.30	0.05

The expected value of the probability distribution of X is 19.25 and the standard deviation is 5.76. There is a fixed cost to deliver the concrete. The profit Y , in dollars, for a particular order can be described by $Y = 75X - 100$. What is the standard deviation of Y ?

- (A) \$332.00
 (B) \$432.00
 (C) \$532.00
 (D) \$1,343.75
 (E) \$1,400.00

NO! $\sigma_y = 75 \cdot \sigma_x$ NO constants!
 $= 75(5.76)$
 $= \$432$

2. A company that makes fleece clothing uses fleece produced from two farms, Northern Farm and Western Farm. Let the random variable X represent the weight of fleece produced by a sheep from Northern Farm. The distribution of X has mean 14.1 pounds and standard deviation 1.3 pounds. Let the random variable Y represent the weight of fleece produced by a sheep from Western Farm. The distribution of Y has mean 6.7 pounds and standard deviation 0.5 pound. Assume X and Y are independent. Let W equal the total weight of fleece from 10 randomly selected sheep from Northern Farm and 15 randomly selected sheep from Western Farm. Which of the following is the standard deviation, in pounds, of W ?

$$\text{Var} = 10(1.3)^2 + 15(0.5)^2$$

$$\text{SD} = \sqrt{\text{Var}}$$

* Combine indiv. sheep $X_1 + X_2 + X_3 \dots$



Key

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- (A) $1.3 + 0.5$
 (B) $\sqrt{1.3^2 + 0.5^2}$
 (C) $\sqrt{10(1.3)^2 + 15(0.5)^2}$
 (D) $\sqrt{10^2(1.3)^2 + 15^2(0.5)^2}$
 (E) $\sqrt{\frac{1.3^2}{10} + \frac{0.5^2}{15}}$

3. A nonprofit organization plans to hold a raffle to raise funds for its operations. A total of 1,000 raffle tickets will be sold for \$1.00 each. After all the tickets are sold, one ticket will be selected at random and its owner will receive \$50.00. The expected value for the net gain for each ticket is -\$0.95. What is the meaning of the expected value in this context?

- (A) The ticket owners lose an average of \$0.05 per raffle ticket.
 (B) The ticket owners lose an average of \$0.95 per raffle ticket.
 (C) Each ticket owner will lose \$0.95 per raffle ticket.
 (D) A ticket owner would have to purchase 19 more tickets for the expected value of his or her net gain to increase to \$0.00.
 (E) A ticket owner has a 95 percent chance of having a ticket that is not selected.

Neg = lose!



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4. A summer resort rents rowboats to customers but does not allow more than four people to a boat. Each boat is designed to hold no more than 800 pounds. Suppose the distribution of adult males who rent boats, including their clothes and gear, is normal with a mean of 190 pounds and standard deviation of 10 pounds. If the weights of individual passengers are independent, what is the probability that a group of four adult male passengers will exceed the acceptable weight limit of 800 pounds?

- A 0.023
 B 0.046
 C 0.159
 D 0.317
 E 0.977

$$\mu = 190 + 190 + 190 + 190 = 760$$

$$\sigma^2 = 10^2 + 10^2 + 10^2 + 10^2 = \sqrt{400}$$

$$\sigma = 20$$

$$\text{Ncdf}(800, \infty, 760, 20) = .023$$

5. According to a recent survey, 31 percent of the residents of a certain state who are age 25 years or older have a bachelor's degree. A random sample of 50 residents of the state, age 25 years or older, will be selected. Let the random variable B represent the number in the sample who have a bachelor's degree. What is the probability that B will equal 40?

- A $\binom{50}{40} (0.31)^{40} (0.69)^{10}$
 B $\binom{50}{40} (0.69)^{40} (0.31)^{10}$
 C $\binom{40}{10} (0.31)^{40} (0.69)^{10}$
 D $\binom{40}{10} (0.69)^{40} (0.31)^{10}$
 E $40(0.31)^{50}$

$$n = 50$$

$$x = 40$$

$$p = .31$$

$$1 - p = .69$$



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6. In a certain region, 94 percent of the people have a certain characteristic in their blood. Suppose a group of 45 people from the region are selected at random. Let the random variable B represent the number of people in the sample without the characteristic. Random variable B follows a binomial distribution with a mean of 2.7 people. Which of the following is the best interpretation of the mean? **BIN!**

- A For all groups of 45 people, the average number of people without the characteristic is 2.7.
 B Every group of 45 people will have 2.7 people with the characteristic.
 C Every group of 45 people will have 2.7 people without the characteristic.
 D On average, 2.7 people are selected until finding someone with the characteristic.
 E On average, 2.7 people are selected until finding someone without the characteristic.

7. In a certain board game, a player rolls two fair six-sided dice until the player rolls doubles (where the value on each die is the same). The probability of rolling doubles with one roll of two fair six-sided dice is $\frac{1}{6}$.

What is the probability that it takes three rolls until the player rolls doubles?

- A $\left(\frac{1}{6}\right)^3$
 B $\left(\frac{5}{6}\right)^3$
 C $\left(\frac{1}{6}\right)\left(\frac{5}{6}\right)^2$
 D $\left(\frac{1}{6}\right)\left(\frac{5}{6}\right)^2$
 E $\left(\frac{5}{6}\right)\left(\frac{1}{6}\right)^2$

$$\text{Geom. dist. w/ } p = \frac{1}{6}$$

$$(1-p)^{x-1} \cdot p$$



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8. The following table shows the probability distribution for the number of books a student typically buys at the annual book fair held at an elementary school.

Number of Books	0	1	2	3	4	5	6	7
Probability	0.35	0.20	0.15	0.10	0.07	0.08	0.04	0.01

Let the random variable B represent the number of books a student buys at the next book fair. What is the expected value of B ?

- (A) 0
 (B) 1.00
 (C) 1.79
 (D) 3.50
 (E) 28

$$0 \cdot 0.35 + 1 \cdot 0.20 + 2 \cdot 0.15 + 3 \cdot 0.10 + 4 \cdot 0.07 + 5 \cdot 0.08 + 6 \cdot 0.04 + 7 \cdot 0.01$$

$$\Sigma = 1.79$$

$$E(x) = \Sigma x_i \cdot p_i$$

9. At a large regional collegiate women's swim meet, an official records the time it takes each swimmer to swim 100 meters for all swimmers who compete in only one stroke category. The following table shows the mean times and corresponding standard deviations for the collegiate women at the swim meet for each of the four stroke categories.

Stroke Category	Mean 100 meter Time	Standard Deviation
Backstroke	55.6 seconds	0.70 seconds
Breaststroke	63.3 seconds	0.92 seconds
Butterfly	54.4 seconds	0.94 seconds
Freestyle	50.2 seconds	0.76 seconds

For each of the 4 stroke categories, consider a random variable representing the time of a randomly selected swimmer in that category. What is the standard deviation of the sum of the 4 random variables?

$$\sqrt{.7^2 + .92^2 + .94^2 + .76^2} = \sqrt{2.7976} = 1.67$$



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- (A) 0.83 seconds
 (B) 1.67 seconds
 (C) 2.80 seconds
 (D) 3.32 seconds
 (E) 3.76 seconds

10. According to 2015 census data, 42.7 percent of Colorado residents were born in Colorado. If a sample of 250 Colorado residents is selected at random, what is the standard deviation of the number of residents in the sample who were born in Colorado?

- (A) 6.75
 (B) 7.82
 (C) 10.33
 (D) 11.97
 (E) 61.17

$$\text{Bin. dist. w/ } n = 250 \text{ \& } p = .427$$

$$\begin{aligned} SD &= \sqrt{np(1-p)} \\ &= \sqrt{250(.427)(.573)} \\ &= 7.82 \end{aligned}$$



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11. Consider a data set of positive values, at least two of which are not equal. Which of the following sample statistics will be changed when each value in this data set is multiplied by a constant whose absolute value is greater than 1?

1. The mean ✓
2. The median ✓
3. The standard deviation ✓

Mult. applies to all but shape!

- (A) I only
 (B) II only
 (C) III only
 (D) I and II only
 (E) I, II and III

E

12. The distribution of random variable R has mean 10 and standard deviation 4. The distribution of random variable S has mean 7 and standard deviation 3. If R and S are independent, what are the mean and standard deviation of the distribution of $R - S$?

$$\mu_{R-S} = 10 - 7 = 3$$

$$\sigma_{R-S}^2 = 4^2 + 3^2 = \sqrt{25}$$

$$\sigma = 5$$



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- (A) Mean 3 and standard deviation 1
 (B) Mean 3 and standard deviation 5
 (C) Mean 3 and standard deviation 7
 (D) Mean 17 and standard deviation 1
 (E) Mean 17 and standard deviation 5

B

13. According to a recent survey, 47 percent of the people living in a certain region carry a certain genetic trait. People from the region will be selected at random one at a time until someone is found who carries the genetic trait. Let the random variable G represent the number of people selected to find one person who carries the genetic trait. On average, how many people from the region will need to be selected to find one person who carries the genetic trait?

- (A) 0.47
 (B) 0.69
 (C) 1.55
 (D) 2.00
 (E) 2.13

Geom. dist. w/ $p = .47$

$$\text{Mean} = \frac{1}{p} = \frac{1}{.47} = 2.13$$

E

14. In 2014, 85 percent of households in the United States had a computer. For a randomly selected sample of 200 households in 2014, let the random variable C represent the number of households in the sample that had a computer. What are the mean and standard deviation of C ?

Bin. dist. w/ $n = 200$ & $p = .85$

$$\text{Mean} = n \cdot p = 200(.85) = 170$$

$$\text{SD} = \sqrt{np(1-p)} = \sqrt{200(.85)(.15)} = 5.05$$



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- D**
- (A) The mean is 85 households, and the standard deviation is 0.36 household.
 - (B) The mean is 144.5 households, and the standard deviation is 5.05 households.
 - (C) The mean is 144.5 households, and the standard deviation is 13.04 households.
 - (D)** The mean is 170 households, and the standard deviation is 5.05 households.
 - (E) The mean is 170 households, and the standard deviation is 0.36 household.

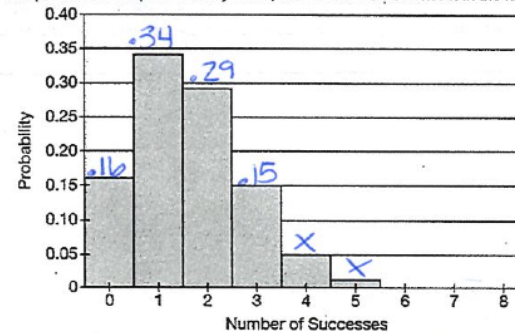
15. In which of the following should the random variable X not be modeled with a geometric distribution?

- (A) According to a recent study, approximately 8% of adults in the country have a master's degree. Let X represent the number of randomly selected adults in the country surveyed to find someone with a master's degree. *until master*
- (B) Suppose it is known that 5% of the light bulbs manufactured at a particular company are defective. Let X represent the number of randomly selected light bulbs that are inspected to find one defective light bulb. *until defective*
- (C) A particular basketball player is known to consistently make 90% of her free throws, and the outcomes of her free-throw attempts are independent. Let X represent the number of attempted free-throws to get one missed free-throw. *until miss*
- (D)** In a bag of 30 different colored candies, about 20% are red. One candy will be selected one at a time without replacement, and its color will be recorded. Let X represent the number of candies selected before red is selected. *BIN! n=30*
- (E) It is believed that about 40% of people in the country have purchased a certain product. Let X represent the number of people randomly selected to find the first one who has purchased the product. *until purchase*



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16. An experiment was conducted in which planks of wood painted red and green were shown to pigeons to investigate a pigeon's ability to select a certain color. Pigeons could accurately select the color of the plank of wood 20 percent of the time. A simulation was conducted in which a trial consisted of a pigeon being shown eight planks of wood and its number of successes being recorded. This process was repeated many times, and the results are shown in the histogram.



Based on the results of the simulation, which of the following is closest to the probability that there were at most three successes in a trial?

- (A) 0.06
- (B) 0.15
- (C) 0.21
- (D) 0.79
- (E)** 0.94

0.16 + 0.34 + 0.29 + 0.15 = 0.94

17. The probability of obtaining a head when a certain coin is flipped is about 0.65. Which of the following is closest to the probability that heads would be obtained 15 or fewer times when this coin is flipped 25 times?

Bin. dist. with $n=25$ & $p=0.65$

binomcdf(25, 0.65, 15) = 0.3697



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- (A) 0.14
- B** (B) 0.37
- (C) 0.39
- (D) 0.60
- (E) 0.65

18. The random variable X is normally distributed with mean 5 and standard deviation 25. The random variable Y is defined by $Y = 2 + 4X$. What are the mean and the standard deviation of Y ?

- (A) The mean is 20 and the standard deviation is 102.
- (B) The mean is 20 and the standard deviation is 50.
- (C) The mean is 22 and the standard deviation is 102.
- D** (D) The mean is 22 and the standard deviation is 100.
- (E) The mean is 22 and the standard deviation is 50.

$\mu_y = 2 + 4(5) = 22$

$\sigma_y = 4(25) = 100$
No constant

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19. The XYZ Office Supplies Company sells calculators in bulk at wholesale prices, as well as individually at retail prices. Next year's sales depend on market conditions, but executives use probability to find estimates of sales for the coming year. The following tables are estimates for next year's sales.

WHOLESALE SALES

Number Sold	2,000	5,000	10,000	20,000
Probability	0.1	0.3	0.4	0.2

$x \cdot p_i$ 200 1500 4000 4000 = 9700 x 20 = 194,000

RETAIL SALES

Number Sold	600	1,000	1,500
Probability	0.4	0.5	0.1

$x \cdot p_i$ 240 500 150 = 890 x 30 = 26,700

What profit does XYZ Office Supplies Company expect to make for the next year if the profit from each calculator sold is \$20 at wholesale and \$30 at retail.

- (A) \$10,590
- B** (B) \$220,700
- (C) \$264,750
- (D) \$833,100
- (E) \$1,002,500

Total = 194000 + 26700 = 220700

20. The random variable W has a geometric distribution with $p = 0.25$. Approximately how far do the values of W typically vary, on average, from the mean of the distribution?

- (A) 1.73
- (B) 2.00
- (C) 3.00
- D** (D) 3.46
- (E) 4.00

Geom. dist. w/ $p = .25$

$SD = \frac{\sqrt{1-p}}{p} = \frac{\sqrt{1-.25}}{.25} = 3.46$