

Chapter 6 AP Statistics PRACTICE Test

Section I: Multiple Choice Select the best answer for each question.

Questions T6.1 and T6.2 refer to the following setting. A psychologist studied the number of puzzles that subjects were able to solve in a five-minute period while listening to soothing music. Let X be the number of puzzles completed successfully by a subject. The psychologist found that X had the following probability distribution:

Value of X :	1	2	3	4
Probability:	0.2	0.4	0.3	0.1
$x_i p_i$.2	.8	.9	.4

T6.1. What is the probability that a randomly chosen subject completes at least 3 puzzles in the five-minute period while listening to soothing music?

- (a) 0.3
- (b) 0.4
- (c) 0.6
- (d) 0.9
- (e) Cannot be determined

$P(X \geq 3) = .3 + .1 = .4$

T6.2. Suppose that three randomly selected subjects solve puzzles for five minutes each. The expected value of the total number of puzzles solved by the three subjects is

- (a) 1.8.
- (b) 2.3.
- (c) 2.5.
- (d) 6.9.
- (e) 7.5.

$E(X) = \sum x_i p_i = .2 + .8 + .9 + .4 = 2.3$
 $E(3 \text{ Subjects}) = 2.3 + 2.3 + 2.3 = 6.9$

T6.3. Suppose a student is randomly selected from your school. Which of the following pairs of random variables are most likely independent?

- (a) X = student's height; Y = student's weight NOT IND
- (b) X = student's IQ; Y = student's GPA NOT IND
- (c) X = student's PSAT Math score; Y = student's PSAT Verbal score NOT IND
- (d) X = average amount of homework the student does per night; Y = student's GPA NOT IND
- (e) X = average amount of homework the student does per night; Y = student's height INDEPENDENT - ONE DOES NOT INFLUENCE THE OTHER

T6.4. A certain vending machine offers 20-ounce bottles of soda for \$1.50. The number of bottles X bought from the machine on any day is a random variable with mean 50 and standard deviation 15. Let the random variable Y equal the total revenue from this machine on a given day. Assume that the machine works properly and that no sodas are stolen from the machine. What are the mean and standard deviation of Y ?

- (a) $\mu_Y = \$1.50, \sigma_Y = \22.50
- (b) $\mu_Y = \$1.50, \sigma_Y = \33.75
- (c) $\mu_Y = \$75, \sigma_Y = \18.37
- (d) $\mu_Y = \$75, \sigma_Y = \22.50
- (e) $\mu_Y = \$75, \sigma_Y = \33.75

$X: \mu_x = 50 \quad \sigma_x = 15$
 $Y = \text{TOTAL Revenue } (\$1.50 \cdot X)$
 $\mu_y = 50 * 1.5 = \$75$
 $\sigma_y = 15 * 1.5 = \$22.50$

Questions T6.5 and T6.6 refer to the following setting. The weight of tomatoes chosen at random from a bin at the farmer's market is a random variable with mean $\mu = 10$ ounces and standard deviation $\sigma = 1$ ounce. Suppose we pick four tomatoes at random from the bin and find their total weight T .

Tomato $\mu = 10$ $\sigma = 1$

T6.5. The random variable T has a mean of

- (a) 2.5 ounces.
- (b) 4 ounces.
- (c) 10 ounces.
- (d) 40 ounces.
- (e) 41 ounces.

$E(4 \text{ Tomatoes}) = 10 + 10 + 10 + 10 = 40$

T6.6. The random variable T has a standard deviation of

- (a) 0.25.
- (b) 0.50.
- (c) 0.71.
- (d) 2.
- (e) 4.

$SD(4 \text{ Tomatoes}) =$

$\sqrt{1^2 + 1^2 + 1^2 + 1^2} =$

$\sqrt{4} = 2$

T6.7. Which of the following random variables is geometric?

- (a) The number of times I have to roll a die to get two 6s.
- (b) The number of cards I deal from a well-shuffled deck of 52 cards until I get a heart.
- (c) The number of digits I read in a randomly selected row of the random digits table until I find a 7. *LOOKING FOR THE 1ST OCCURRENCE of 7*
- (d) The number of 7s in a row of 40 random digits.
- (e) The number of 6s I get if I roll a die 10 times.

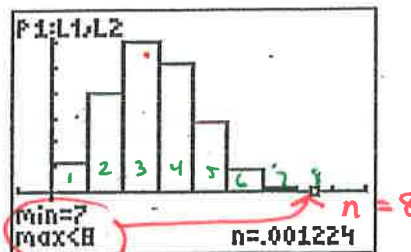
T6.8. Seventeen people have been exposed to a particular disease. Each one independently has a 40% chance of contracting the disease. A hospital has the capacity to handle 10 cases of the disease. What is the probability that the hospital's capacity will be exceeded?

- (a) 0.011
- (b) 0.035
- (c) 0.092
- (d) 0.965
- (e) 0.989

$n = 17$
 $p = .40$
BINS
 $B(17, .4)$

$P(X > 10) = 1 - P(X \leq 10)$
 $1 - .965 = .035$
 $\text{binomcdf}(17, .4, 10) = .965$

T6.9. The figure shows the probability distribution of a discrete random variable X . Which of the following best describes this random variable?



- (a) Binomial with $n = 8, p = 0.1$
- (b) Binomial with $n = 8, p = 0.3$
- (c) Binomial with $n = 8, p = 0.8$
- (d) Geometric with $p = 0.1$
- (e) Geometric with $p = 0.2$

Geometric is typically skewed Right

T6.10. A test for extrasensory perception (ESP) involves asking a person to tell which of 5 shapes—a circle, star, triangle, diamond, or heart—appears on a hidden computer screen. On each trial, the computer is equally likely to select any of the 5 shapes. Suppose researchers are testing a person who does not have ESP and so is just guessing on each trial. What is the probability that the person guesses the first 4 shapes incorrectly but gets the fifth correct?

- (a) $1/5$
- (b) $(\frac{4}{5})^4$
- (c) $(\frac{4}{5})^4 \cdot (\frac{1}{5})$
- (d) $(\frac{5}{1}) \cdot (\frac{4}{5})^4 \cdot (\frac{1}{5})$
- (e) $4/5$

$P(S) = 1/5$
 $P(F) = 4/5$
 $P(F F F F S)$

Multiple choice: Select the best answer for Exercises 27 to 30.

Exercises 27 and 28 refer to the following setting. Choose an American household at random and let the random variable X be the number of cars (including SUVs and light trucks) they own. Here is the probability model if we ignore the few households that own more than 5 cars:

Number of cars X :	0	1	2	3	4	5
Probability:	0.09	0.36	0.35	0.13	0.05	0.02

$\approx 100\%$

X	\$10	-1
$P(X)$	$4/52$	$48/52$

29. A deck of cards contains 52 cards, of which 4 are aces. You are offered the following wager: Draw one card at random from the deck. You win \$10 if the card drawn is an ace. Otherwise, you lose \$1. If you make this wager very many times, what will be the mean amount you win?

- (a) About -\$1, because you will lose most of the time.
- (b) About \$9, because you win \$10 but lose only \$1.
- (c) About -\$0.15; that is, on average you lose about 15 cents. $10(4/52) + (-1)(48/52) = -.1538$
- (d) About \$0.77; that is, on average you win about 77 cents.
- (e) About \$0, because the random draw gives you a fair bet.

27. A housing company builds houses with two-car garages. What percent of households have more cars than the garage can hold?

- (a) 13%
 - (b) 20%
 - (c) 45%
 - (d) 55%
 - (e) 80%
- $P(X > 2) = .13 + .05 + .02 = 20\%$

30. The deck of 52 cards contains 13 hearts. Here is another wager: Draw one card at random from the deck. If the card drawn is a heart, you win \$2. Otherwise, you lose \$1. Compare this wager (call it Wager 2) with that of the previous exercise (call it Wager 1). Which one should you prefer?

- (a) Wager 1, because it has a higher expected value.
- (b) Wager 2, because it has a higher expected value.
- (c) Wager 1, because it has a higher probability of winning.
- (d) Wager 2, because it has a higher probability of winning.
- (e) Both wagers are equally favorable.

28. What's the expected number of cars in a randomly selected American household?

- (a) Between 0 and 5
- (b) 1.00
- (c) 1.75
- (d) 1.84
- (e) 2.00

$$E(X) = \sum x_i p_i = 0 + .36 + 2(.35) + 3(.13) + 4(.05) + 5(.02) = 0 + .36 + .70 + .39 + .2 + .1 = 1.75$$

OR

① PUT IN L1 and L2

x_i	p_i
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② 1VARSTATS L1, L2 $E(X) \rightarrow \bar{X}$

X	\$2	-\$1
$P(X)$	$1/4$	$3/4$

$$E(X) = 2(1/4) + (-1)(3/4) = -.25$$

WAGER 1 (#29) = $\mu = -.15$
 WAGER 2 (#30) = $\mu = -.25$

Multiple choice: Select the best answer for Exercises 65 and 66, which refer to the following setting. The number of calories in a one-ounce serving of a certain breakfast cereal is a random variable with mean 110 and standard deviation 10. The number of calories in a cup of whole milk is a random variable with mean 140 and standard deviation 12. For breakfast, you eat one ounce of the cereal with 1/2 cup of whole milk. Let T be the random variable that represents the total number of calories in this breakfast.

1oz cereal $\mu_c = 110$ $\sigma_c = 10$

1/2 cup milk $\mu_m = 140$ $\sigma_m = 12$

$T = 1\text{oz cereal} + 1/2\text{ cup milk}$

$E(T) = 110 + 1/2(140) = 180 \leftarrow \#65$

$VAR(T) = 10^2 + (\frac{1}{2} \cdot 12)^2 = 136$

$\sigma_T = \sqrt{136} = 11.66 \leftarrow \#66$

Multiple choice: Select the best answer for Exercises 101 to 105.

101. Joe reads that 1 out of 4 eggs contains salmonella bacteria. So he never uses more than 3 eggs in cooking. If eggs do or don't contain salmonella independently of each other, the number of contaminated eggs when Joe uses 3 chosen at random has the following distribution:

- (a) binomial; $n = 4$ and $p = 1/4$
- (b) binomial; $n = 3$ and $p = 1/4$
- (c) binomial; $n = 3$ and $p = 1/3$
- (d) geometric; $p = 1/4$
- (e) geometric; $p = 1/3$

$B(3, 1/4)$

$n = 3$ EGGS

$p = 1/4 = .25$

binomial - bad or NOT

independent stated

65. The mean of T is
 (a) 110. (b) 140. (c) 180. (d) 195. (e) 250.

66. The standard deviation of T is
 (a) 22. (b) 16. (c) 15.62. (d) 11.66. (e) 4.

102. In the previous exercise, the probability that at least 1 of Joe's 3 eggs contains salmonella is about

- (a) .084. (b) 0.68. (c) 0.58. (d) 0.42. (e) 0.000

$P(\text{at least 1 of 3 bad}) = 1 - P(\text{None}) = 1 - (.75)^3 = .578$

105. In which of the following situations would it be appropriate to use a Normal distribution to approximate probabilities for a binomial distribution with the given values of n and p ? Check $np + nq > 10$

- (a) $n = 10, p = 0.5$ $10(.5) = 5 \times$
- (b) $n = 40, p = 0.88$ $40(.12) = 4.8 \times$
- (c) $n = 100, p = 0.2$ BOTH check
- (d) $n = 100, p = 0.99$ $100(.01) = 1 \times$
- (e) $n = 1000, p = 0.003$ $1000(.003) = 3 \times$

$np = 100(.2) = 20 > 10 \checkmark$

$nq = 100(.8) = 80 > 10 \checkmark$