Name KEY

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.

$E(X) = \Sigma x_i p_i = .2 + .8 + .9 + .4 = 2.3$

$E(\text{3 Subjects}) = 2.3 + 2.3 + 2.3 = 6.9$

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 = 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 Tomatoes) = 10 + 10 + 10 + 10 = 40

T6.6. The random variable T has a standard deviati n ounces) of
(a) 0.25. (b) 0.50. (c) 0.71. (d) 2. (e) 4.

SD (4 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.

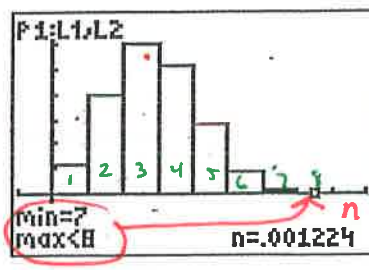
T6.8. Seventeen people have been exposed to a particular disease. Each one independently has a 40% chance of contracting the disease. A hospital has the capacity to handle 10 cases of the disease. What is the probability that the hospital's capacity will be exceeded?
(a) 0.011 (b) 0.035 (c) 0.092 (d) 0.965 (e) 0.989

n = 17
p = .40
BINS ✓✓✓✓
B (17, .4)

$P(X > 10) = 1 - P(X \leq 10)$
$1 - .965 = .0348$

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) $\left(\frac{4}{5}\right)^4$
(c) $\left(\frac{4}{5}\right)^4 \cdot \left(\frac{1}{5}\right)$
(d) $\binom{5}{1} \cdot \left(\frac{4}{5}\right)^4 \cdot \left(\frac{1}{5}\right)$
(e) 4/5

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

T6.11

Y = # broken eggs in 1 dozen carton

(a) P(at least 10 eggs unbroken (out of the 12)) = $P(Y \leq 2)$

Use the probability distribution for Y given:

$$P(Y \leq 2) = P(Y=0) + P(Y=1) + P(Y=2)$$
$$.78 + .11 + .07 = .96$$

(in context) There is a 96% chance that 2 or fewer eggs are broken. That is there is a 96% chance that at least 10 eggs are unbroken in a randomly selected carton of "store brand" eggs.

(b) $\mu_Y = 0(.78) + 1(.11) + 2(.07) + 3(.03) + 4(.01) = .38$

$\mu_Y = .38$ (in context) We expect, on average, to find .38 broken eggs in a carton of a dozen eggs.

(c) $\boxed{\sigma_Y^2 = \Sigma (x_i - \mu_x)^2 \cdot p_i}$ $\sigma_Y = \sqrt{(0-.38)^2(.78) + \dots + (4-.38)^2(.01)} = .8219$

Show either for work

IN CALC> L1 = y_i's
L2 = p_i's
1VAR STATS
LIST: L1
FREQ LIST: L2
⇓
$\Sigma x = \mu_x = .38$
$\sigma x = .8219$

(in context) Individual cartons will vary from .38 broken eggs by about .82 broken eggs, on average

CONT ⟶

T6.11 d

1^{ST} FIND: P(at least 2 broken eggs) = $P(Y=2) + P(Y=3) + P(Y=4)$

$P(Y \geq 2) = .07 + .03 + .01 = .11$

2^{ND} - Notice this is a geometric probability because you are looking for the 1^{ST} broken EGG.

Check Geom. Conditions

B - broken/NOT broken

I - eggs independent

T - 1st broken egg

S - fixed prob success $p = .11$

STATE THE Distribution with appropriate parameters either $G(.11)$ or geometric distribution with $p = .11$

3rd - find the probability for $G(.11)$

1^{ST} Broken egg found in one of first 3 cartons.

$P(Y \leq 3) = .2950$

Geometcdf(.11, 3)

4^{TH}

(Context) The probability of finding at least 2 broken eggs in one of the first 3 randomly selected cartons is about 30%

T6.12

X = the number of owners who greet their dog first

(a) X is a binomial random variable because it meets the required conditions

B - own greets dog first or does NOT.
I - dog owners are independent
N - fixed trials $n = 12$
S - fixed probability of success $p = .66$

(b) $P(Y \leq 4) = .0213$ binomcdf(12, .66, 4) ← NOT Needed to show

remember to state model
$B(n, p) = B(12, .66)$

(Context)
We found the probability of getting a sample of 4 or fewer dog owners greeting their dogs first when they get home is only about 2%. This is reasonably unlikely to occur, so we would be skeptical that the "Ladies Home Journal's" claim is true.

T6.13

define RV's

E = amount of time for Ed to complete Hw → $N(25, 5)$

A = amount of time for Adelaide to complete Hw → $N(50, 10)$

(a) RV: $D = A - E$

$E(A-E) = \mu_D = 50 - 25 = 25$ minutes

$VAR(A-E) = \sigma_D^2 = 5^2 + 10^2 = 125$ ← Assuming amount of time spent by Ed and Adelaide is independent

$SD(A-E) = \sigma_D = \sqrt{125}$

$= 11.18$ minutes

(b) FIND $P(E > A)$

$-E \quad -E$

↓

$P(0 > A - E)$

$\parallel$

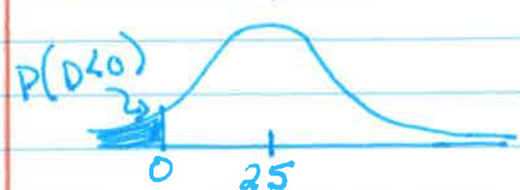
$P(A - E < 0) = P(D < 0)$

Use your algebra skills to rework this Probability to use the RV "D = A − E" calculated above

STATE model

$N(25, 11.18)$

Sketch Graph



$P(D<0) = .01267$

normalcdf(−E99, 0, 25, 11.18)

(Context) The probability that Ed will spend more time on homework than Adelaide is very small, about 1.3%.

T6.14

Census Bureau 13% Hispanic adults
Poll – SRS $n = 1{,}200$ adults

(a) X = the number of hispanic adults

(1) **Binomial Model Conditions**
B = Hispanic or NOT
I = SRS
N = Fixed trials $n = 1{,}200$
S = Fixed prob success $p = .13$

(2) model $B(1200, .13)$

(3) $E(x) = \mu_x = np = 1200(.13)$
$\boxed{\mu_x = 156}$

(4) $SD(x) = \sqrt{np(1-p)} = \sqrt{1200(.13)(.87)}$
$\boxed{\sigma_x = 11.65}$

(b) Suspicious if 15% of the sample is Hispanic
$15\% = 1200(.15) = 180$ Hispanics

$\boxed{P(x \geq 180)}$

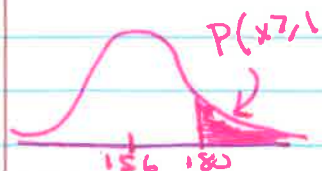
Binomial Model method
remember discrete RV
model $B(1200, .13)$

$P(x \geq 180) = 1 - P(x \leq 179)$
$= 1 - .9765$
binomcdf(1200, .13, 179)
$= .0235$

Normal Approximation model
Check Normal condition
$np = 1200(.13) = 156 \geq 10$ ✓
$n(1-p) = 1200(.87) = 1{,}044 \geq 10$ ✓

State model $\boxed{N(156, 11.56)}$
$E(x) = np = 156$
$SD(x) = \sqrt{1200(.13)(.87)} = 11.56$

$P(x \geq 180) = .0189$
normalcdf(180, E99, 156, 11.56)



(Context) The probability that 15% of the random sample is Hispanic is very small (about 2%). Therefore we would be suspicious of the opinion poll.