NAME:

SECTION 7.5B Exercises (Attach Work)

In Exercises 69 to 72, explain whether the given random variable has a binomial distribution.

69. **Sowing seeds** Seed Depot advertises that 85% of its flower seeds will germinate (grow). Suppose that the company's claim is true. Judy buys a packet with 20 flower seeds from Seed Depot and plants them in her garden. Let X = the number of seeds that germinate.

70. **Long or short?** Put the names of all the students in your class in a hat. Mix them up, and draw four names without looking. Let Y = the number whose last names have more than six letters.

71. **Lefties** Exactly 10% of the students in a school are left-handed. Select students at random from the school, one at a time, until you find one who is left-handed. Let V = the number of students chosen.

72. **Lefties** Exactly 10% of the students in a school are left-handed. Select 15 students at random from the school and define W = the number who are left-handed.

75. **Blood types** In the United States, 44% of adults have type O blood. Suppose we choose 7 U.S. adults at random. Let X = the number who have type O blood. Use the binomial probability formula to find $P(X = 4)$. Interpret this result in context.

76. **Rhubarb** Suppose you purchase a bundle of 10 bare-root rhubarb plants. The sales clerk tells you that on average you can expect 5% of the plants to die before producing any rhubarb. Assume that the bundle is a random sample of plants. Let Y = the number of plants that die before producing any rhubarb. Use the binomial probability formula to find $P(Y = 1)$. Interpret this result in context.

78. **Rhubarb** Refer to Exercise 76. Would you be surprised if 3 or more of the plants in the bundle die before producing any rhubarb? Calculate an appropriate probability to support your answer.

80. **More lefties** Refer to Exercise 72.

(a) Find the probability that exactly 3 students in the sample are left-handed. Show your work.

INTERPRET RESULT IN CONTEXT.

81. **Random digit dialing** When an opinion poll calls residential telephone numbers at random, only 20% of the calls reach a live person. You watch the random digit dialing machine make 15 calls. Let X = the number of calls that reach a live person.

(a) Find and interpret μ_X.

(b) Find and interpret σ_X.

83. **Random digit dialing** Refer to Exercise 81. Let Y = the number of calls that *don't* reach a live person.

(a) Find the mean of Y. How is it related to the mean of X? Explain why this makes sense.

(b) Find the standard deviation of Y. How is it related to the standard deviation of X? Explain why this makes sense.

BINOMIAL ACTIVITY

- There are 2 handouts

(1) BINOMIAL ACTIVITY (with the scenario of 10 light bulbs)

(2) GRAPH TEMPLATE – You will be assigned 1 of the scenarios. You are to make a presentation quality Graph & be prepared to explain to class

→ FIND THE FOLLOWING PROBABILITIES. SHOW WORK. FIND %'S. NO CONTEXT.

(b) $P(W = 0)$
(c) $P(W = 1)$
(d) $P(W = 2)$
(e) $P(W \geq 4)$

7.5 B HW ANSWERS

(69) BINARY (Y) GERMINATE VS. NOT
INDEPENDENT - SEEMS REASONABLE EACH SEED IS INDEPENDENT
NUMBER FIXED (Y) 20 SEEDS N=20
SUCCESS (Y) FIXED Probability Success p=.85

Random Variable X = # of seeds that germinate

ASSUMING INDEPENDENCE HOLDS, THIS IS A BINOMIAL SETTING AND X HAS A BINOMIAL DISTRIBUTION B(20,.85)

(70) B
I (NO) SINCE SAMPLING WITHOUT REPLACEMENT & A SMALL Sample. WE CAN NOT ASSUME INDEPENDENCE
N ✓ N=4
S

THIS IS NOT A BINOMIAL DISTRIBUTION

(71) B [Y] - LEFT vs RIGHT
I [Y] - Selected randomly
N (NO) THERE IS NOT FIXED NUMBER OF TRIALS
S

THIS IS NOT A BINOMIAL DISTRIBUTION

(72) B: yes - left vs right
I: yes - randomly selected
N: yes - fixed number of trials n=15
S: yes - the probability of lefty remains constant from one student to the next. p=.10

RANDOM VARIABLE W = the number who are lefty's

This is a binomial setting and W has a binomial distribution B(15,.10)

75

X = # who have type O blood

$p = .44$ (probability type O)

$q = .56$

$N = 7$

Define distribution $B(7, .44)$

$$P(X=4) = \binom{N}{K} p^K (1-p)^{N-K}$$

$$= \binom{7}{4} (.44)^4 (.56)^3$$

$$= 35 \; (.44)^4 (.56)^3$$

$P(X=4) = .23037$

Yellow- make sure to write these assumptions

Know how to do these calculations

USING CALC → CAN NOW USE CALC TO FIND Probability

$P(X=4) = \text{binompdf}(7, .44, 4)$

$P(X=4) = .23037$

# of COMBINATIONS

$$\binom{7}{4} = \binom{n}{k} = \frac{N!}{K!(N-K)!}$$

$$= \frac{7!}{4!3!} = \frac{7 \cdot 6 \cdot 5}{3 \cdot 2}$$

$$\binom{7}{4} = 35 \quad =$$

CALC → 7 nCr 4 = 35

(math) (PRB) (3)

**** MUST WRITE ANSWER IN CONTEXT:

There is about a 23% chance that exactly 4 of the 7 chosen have blood type O

76 Y = # OF PLANTS THAT DIE BEFORE PRODUCING ANY RHUBARD

$n = 10$ $B(10, .05)$

$p = .05$

$q = .95$

$P(Y=1) = \text{binompdf}(10, .05, 1) = .3151$

THERE is about a 32% chance that exactly 1 OF THE 10 RHUBARD PLANTS WILL DIE BEFORE PRODUCING RHUBARB.

78 $P(Y \geq 3) = 1 - P(Y \leq 2) = 1 - \text{binomcdf}(10, .05, 2)$

$= 1 - .9885 = .0115$

THERE IS ABOUT A 1% CHANCE THAT 3 OR MORE OF THE PLANTS WILL DIE BEFORE PRODUCING RHUBARD. THIS WOULD BE SURPRISING IF IT OCCUERED

80 W = # OF LEFTY'S $B(15, .10)$

(a) $P(W=3) = \text{binompdf}(15, .1, 3) = .1285$

THERE IS ABOUT A 13% chance that exactly 3 of the 15 students WERE LEFT HANDED

(b) $P(W=0) = \text{binompdf}(15, .1, 0) =$ 20.59%

(c) $P(W=1) = \text{binompdf}(15, .1, 1) =$ 34.32%

(d) $P(W=2) = \text{binompdf}(15, .1, 2) =$ 26.69%

(e) $P(W \geq 4) = 1 - P(W \leq 3) = 1 - .9444 = .0555$ 5.56%

DOUBLE CHECKED:

$P(W=0) + P(W=1) + P(W=2) + P(W=3) =$

$.2059 + .3432 + .2669 + .1285 = .9445$ Checks :)

(81) Check assumptions for a binomial distribution

B = BINARY REACH or DON'T REACH

I = INDEPENDENT YES, RANDOMLY SELECTED

N = FIXED # of trials (n = 15)

S = Fixed probcbility for success (p = .2)

Assumptions - were met

X = the number of calls that reach a live person

$B(15, .2)$

CONTEXT:

(a) $\mu_X = np = 15(.2) = 3$ You would expect to reach a live person in an average of 3 phone calls when making 15 calls

(b) $\sigma_X = \sqrt{np(1-p)} = \sqrt{15(.2)(.8)} = 1.549$

CONTEXT:

IN ACTUAL PRACTICE, YOU WOULD EXPECT THE NUMBER OF LIVE PERSONS YOU REACH TO VARY FROM 3 per 15 calls by 1.55 calls, on average

(83) Y = # OF CALLS THAT YOU DO NOT REACH A LIVE PERSON $B(15, .8)$

(a) $\mu_Y = np = 15(.8) = 12$

Notice $\mu_X = 3$ and $12 + 3 = 15$. In other words, if we reach an average of 3 LIVE PERSONS IN OUR 15 CALLS, Then we must not reach a LIVE PERSON IN AN AVERAGE OF 12 Calls.

(b) $\sigma_Y = \sqrt{N p(1-p)} = \sqrt{npq} = \sqrt{15(.8)(.2)} = 1.549$

σ_X and σ_Y are the same thing as we have just switch the definitions of p and 1-p.