Statistics 4-2: Binomial Distributions

**Objective 1: I can determine if a probability experiment is a binomial experiment.**

There are many probability experiments for which the results of each trial can be reduced to two outcomes: \_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_. For instance, when a basketball player attempts a free throw, he or she either makes it or misses it. Probability experiments in which there are exactly two outcomes are called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is a probability experiment that has the following properties:

1) The experiment is \_\_\_\_\_\_\_\_\_\_\_\_\_ for a fixed number of \_\_\_\_\_\_\_\_\_\_\_, where each trial is

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the other trials.

2) There are only \_\_ possible outcomes that can be classified as a success, \_\_\_, or a failure, \_\_\_.

3) The probability of success, \_\_\_\_\_\_, is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

4) The random variable *x* counts the number of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Notation for binomial experiments**

*n*

*p = P(S)*

*q = P(F)*

*x*

\*Read the bottom of page 206.

\*Read Ex 1, pg 207.

TIY 1: Decide whether the following is a binomial experiment. If it is, specify the values of *n*, *p*, and *q,* and list the possible values of the random variable. If it is not, explain why.

You take a multiple-choice quiz that consists of 10 questions. Each question has 4 possible answers, only one of which is correct. To complete the quiz, you randomly guess the answer to each question. The random variable *x* represents the number of correct answers.

**Objective 2: I can find binomial probabilities using the binomial probability formula.**

There are several ways to find the probability of *x* successes in *n* trials of a binomial experiment. One way is to use a tree diagram and the Multiplication Rule. Another way is to use the formula below.

In a binomial experiment, the probability of exactly *x* successes in *n* trials is:

Example 2: Microfracture knee surgery has a 75% chance of success on patients with degenerative knees. The surgery is performed on 3 patients. Find the probability of the knee surgery being successful on exactly 2 patients.

**Method 1: Tree Diagram**: Look on page 208 to see if this method might work better for you.

**Method 2: Formula:**

TIY 2: A card is selected from a standard deck and replaced. This experiment is repeated a total of 5 times. Find the probability of selecting exactly 3 clubs.

By listing the possible values of x (all of the \_\_\_\_\_\_\_\_\_\_) along with their corresponding

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, you can construct a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

\*Read Ex 3, pg 209

TIY 3: Seven workers who participated in the survey are randomly selected and asked whether they expect to rely on a pension for retirement income.

A) Create a binomial distribution for the number of retirees who responded yes.

B) Then use the probability distribution to answer the questions below.

|  |  |  |
| --- | --- | --- |
| x | Calc Steps | P(x) |
| 0 |  |  |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |
| 5 |  |  |
| 6 |  |  |
| 7 |  |  |

i) What is the probability that at least 4 people respond yes?

ii) What is the probability that no more than 2 respond yes?

iii) What is the probability that exactly 5 respond yes?

**Objective 3: I can find binomial probabilities using the calculator.**

In previous examples and homework, you used the binomial probability formula to find the probabilities. There is a calculator shortcut ☺

**Calculator Shortcuts:**

Binompdf: Used to find an \_\_\_\_\_\_\_\_\_\_ number of successes.

Binomcdf: Use to find an \_\_\_\_\_\_\_\_\_\_\_\_\_ of successes

Example 4: The results of a recent survey indicate that when grilling, 59% of households in the US use a gas grill. If you randomly select 100 households, what is the probability that exactly 65 use a gas grill?

TIY 4: The results of a survey indicated that 71% of people in the US use more than one topping on their hot dogs. If you randomly select 250 people, what is the probability that exactly 178 of them will use more than topping?

Ex 5: A survey indicates that 41% of women in the US consider reading their favorite leisure-time activity. You randomly select 40 US women and ask them if reading is their favorite leisure-time activity. Find each probability.

(1) That exactly twenty-two of them respond yes.

(2) That at least thirty of them respond yes.

(3) That fewer than twenty-five respond yes.

TIY 5: A survey indicates that 21% of men in the US consider fishing their favorite leisure-time activity. You randomly select 15 US men and ask them if fishing is their favorite leisure-time activity. Find each probability.

(1) That exactly 12 of them respond yes.

(2) That no more than nine of them respond yes.

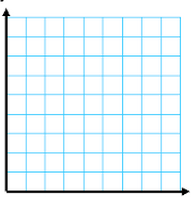
(3) That at least 10 of them respond yes.

**Objective 4: I can graph a binomial probability distribution**

We can graph a binomial probability distribution using a histogram.

Read Ex 7, pg 213

TIY 7: 82% of households in the US own a computer. You randomly select 6 households and ask if the own a computer. Construct and graph a probability distribution.



**Objective 5: I can find the mean, variance, and SD of a binomial probability distribution.**

You can use the formulas from 4.1 to find the mean, variance, and SD of a binomial probability distribution, but there are some easier formulas.

**Mean Variance Standard Deviation (SD)**

TIY 8: In San Francisco, 44% of the days in a year are clear. Find the mean, variance, and standard deviation for the number of clear days during the month of May. Interpret these results.

TIY 8.5: 82% of households in the US own a computer. You randomly select 6 households and ask if the own a computer. Find the mean, variance, and standard deviation for the number of computers in a household.