Binomial Experiment qalifications:

1. The experiment is performed a fixed number of times. Each repetition of the experiment is called a trial.
2. The trials are independent. This means the outcome of one trial will not affect the outcome of the other trials.
3. For each trial, there are two mutually exclusive (disjoint) outcomes, success or failure.
4. The probability of success is the same for each trial of the experiment.

1) Determine if the following probability experiment represents a binomial experiment.

A random sample of 80 college professors is obtained, and the individuals selected are asked to state their ages.

- ✔ A. No, this probability experiment does not represent a binomial experiment because the variable is continuous, and there are not two mutually exclusive outcomes.

2) Determine whether the following probability experiment represents a binomial experiment and explain the reason for your answer.

An experimental drug is administered to 170 randomly selected individuals, with the number of individuals responding favorably recorded.

Does the probability experiment represent a binomial experiment?

- ○ A. No, because the probability of success differs from trial to trial.
- ○ B. No, because there are more than two mutually exclusive outcomes for each trial.
- ○ C. No, because the trials of the experiment are not independent.
- ✔ D. Yes, because the experiment satisfies all the criteria for a binomial experiment.

3) Determine whether the following probability experiment represents a binomial experiment and explain the reason for your answer.

Three cards are selected from a standard 52-card deck without replacement. The number of tens selected is recorded.

Does the probability experiment represent a binomial experiment?

- ○ A. Yes, because the experiment satisfies all the criteria for a binomial experiment.
- ✔ B. No, because the trials of the experiment are not independent and the probability of success differs from trial to trial.

4) Determine whether the following probability experiment represents a binomial experiment and explain the reason for your answer.

An investor randomly purchases 9 stocks listed on a stock exchange. Historically, the probability that a stock listed on this exchange will increase in value over the course of a year is 43%. The number of stocks that increase in value is recorded.

Does the probability experiment represent a biniomial experiment?

- A. No, because there are more than two mutually exclusive outcomes for each trial.
- B. Yes, because the experiment satisfies all the criteria for a binomial experiment. ✔

5) What is the formula for the expected number of successes in a binomial experiment with n trials and probability of success p?

Choose the correct forumla below.

- A. $E(X) = np$ ✔

6) A binomial probability experiment is conducted with the given parameters. Compute the probability of x successes in the n independent trials of the experiment.

$n = 10,\ p = 0.3,\ x = 5$

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Stat – Calculator – Binomial

P(5) = .1029

(Do not round until the final answer. Then round to four decimal places as needed.)

n: 10 p: 0.3

P(X = 5) = 0.10291935

Compute

7) A binomial experiment is performed a fixed number of times. What is each repetition of the experiment called?

Choose the correct answer below.

- A. Each repetition of the experiment is called a success.
- B. Each repetition of the experiment is called a binomial random variable.
- C. Each repetition of the experiment is called a mean.
- D. Each repetition of the experiment is called a trial. ✔

8) A binomial probability experiment is conducted with the given parameters. Compute the probability of x successes in the n independent trials of the experiment.

$n = 20,\ p = 0.03,\ x = 2$

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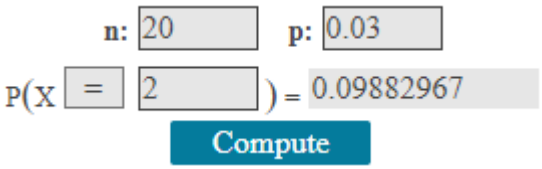
Stat – Calculator – Binomial

P(2) = .0988

(Do not round until the final answer. Then round to four decimal places as needed.)



9) A binomial probability experiment is conducted with the given parameters. Compute the probability of x successes in the n independent trials of the experiment.

$n = 6,\ p = 0.35,\ x = 4$

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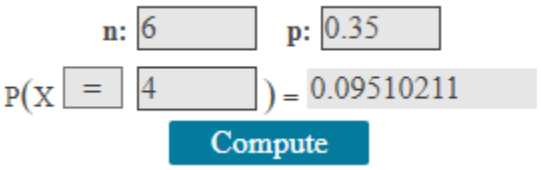
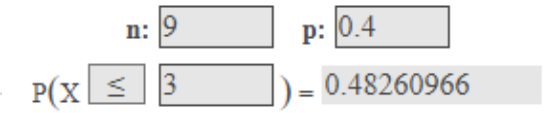
P(4) = .0951

(Do not round until the final answer. Then round to four decimal places as needed.)



10) A binomial probability experiment is conducted with the given parameters. Compute the probability of x successes in the n independent trials of the experiment.

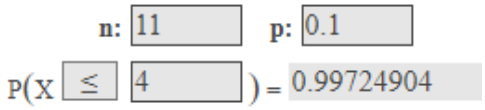
$n = 9,\ p = 0.4,\ x \le 3$



The probability of $x \le 3$ successes is .4826. (Round to four decimal places as needed.)

11) A binomial probability experiment is conducted with the given parameters. Compute the probability of x successes in the n independent trials of the experiment.

$n = 11,\ p = 0.1,\ x \le 4$



The probability of $x \le 4$ successes is .9972. (Round to four decimal places as needed.)

12) According to an airline, flights on a certain route are on time 80% of the time. Suppose 10 flights are randomly selected and the number of on-time flights is recorded.

(a) Explain why this is a binomial experiment.
(b) Find and interpret the probability that exactly 6 flights are on time.
(c) Find and interpret the probability that fewer than 6 flights are on time.
(d) Find and interpret the probability that at least 6 flights are on time.
(e) Find and interpret the probability that between 4 and 6 flights, inclusive, are on time.

(a) Identify the statements that explain why this is a binomial experiment. Select all that apply.

- ☐ A. Each trial depends on the previous trial.
- ☑ B. There are two mutually exclusive outcomes, success or failure.
- ☑ E. The trials are independent.
- ☑ F. The experiment is performed a fixed number of times.
- ☑ G. The probability of success is the same for each trial of the experiment.

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(b) The probability that exactly 6 flights are on time is .0881.
(Round to four decimal places as needed.) **P = 6**

In 100 trials of this experiment, it is expected about 9 to result in exactly 6 flights being on time.
(Round to the nearest whole number as needed.)

(c) The probability that fewer than 6 flights are on time is .0328. **P < 6**
(Round to four decimal places as needed.)

In 100 trials of this experiment, it is expected about 3 to result in fewer than 6 flights being on time.
(Round to the nearest whole number as needed.)

(d) The probability that at least 6 flights are on time is .9672. 6 or higher **P ≥ 6**
(Round to four decimal places as needed.)

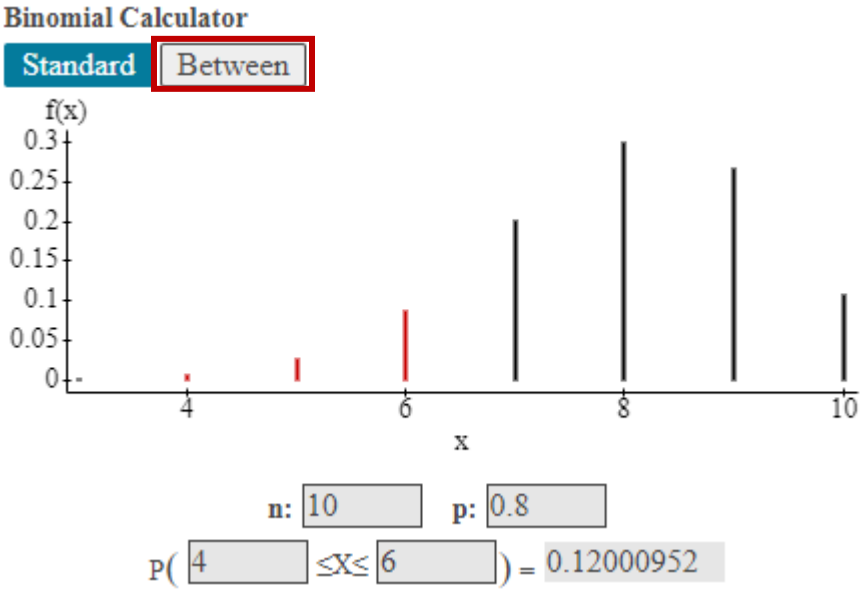
In 100 trials of this experiment, it is expected about 97 to result in at least 6 flights being on time.
(Round to the nearest whole number as needed.)

(e) The probability that between 4 and 6 flights, inclusive, are on time is .1200.
(Round to four decimal places as needed.)

Interpret the probability.

In 100 trials of this experiment, it is expected about 12 to result in between 4 and 6 flights, inclusive, being on time.
(Round to the nearest whole number as needed.)

BEWTEEN



13) According to a study done by a university student, the probability a randomly selected individual will not cover his or her mouth when sneezing is 0.267. Suppose you sit on a bench in a mall and observe people's habits as they sneeze.

(a) What is the probability that among 16 randomly observed individuals exactly 4 do not cover their mouth when sneezing?
(b) What is the probability that among 16 randomly observed individuals fewer than 6 do not cover their mouth when sneezing?

(a) The probability that exactly 4 individuals do not cover their mouth is .2225.
(Round to four decimal places as needed.)

P = 4

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(b) The probability that fewer than 6 individuals do not cover their mouth is .7630.
(Round to four decimal places as needed.)

P < 6

(c) Fewer than half of 16 individuals covering their mouth would be surprising because the probability of observing fewer than half covering their mouth when sneezing is .0118, which is an unusual event.
(Round to four decimal places as needed.)

P > 8 greater bc it is COVERING their mouth (half of 16)

** P < 0.5 is an unusual event

14) Thirteen jurors are randomly selected from a population of 3 million residents. Of these 3 million residents, it is known that 48% are of a minority race. Of the 13 jurors selected, 2 are minorities.

(a) The proportion of the jury described that is from a minority race is .15. $\frac{2}{13}$
(Round to two decimal places as needed.)

(b) The probability that 2 or fewer out of 13 jurors are minorities, assuming that the proportion of the population that are minorities is 48%, is .0162.
(Round to four decimal places as needed.)

P ≤ 2

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D. The number of minorities on the jury is unusually low, given the composition of the population from which it came.

$\mu_x = np$

$\sigma_x = \sqrt{np(1-p)}$

15) Suppose that a recent poll found that 66% of adults believe that the overall state of moral values is poor. Complete parts (a) through (c).

(a) For 400 randomly selected adults, compute the mean and standard deviation of the random variable X, the number of adults who believe that the overall state of moral values is poor.

The mean of X is 264. (Round to the nearest whole number as needed.) $400 \cdot 0.66 = 264$

The standard deviation of X is 9.5. (Round to the nearest tenth as needed.) $\sqrt{400 \cdot 0.66(1-0.66)}$

(c) Would it be unusual if 253 of the 400 adults surveyed believe that the overall state of moral values is poor?

- Yes
- No

16) Which of the following are criteria for a binomial probability experiment?

Select all that apply.

- [x] A. There are two mutually exclusive outcomes, success or failure.
- [ ] B. The experiment is performed until a desired number of successes is reached.
- [ ] C. There are three mutually exclusive outcomes, arriving on-time, arriving early, and arriving late.
- [ ] D. Each trial depends on the previous trial.
- [ ] E. The probability of success is different for each trial of the experiment.
- [x] F. The trials are independent.
- [x] G. The experiment is performed a fixed number of times.
- [x] H. The probability of success is the same for each trial of the experiment.

17) Describe how the value of n affects the shape of the binomial probability histogram.

Choose the correct answer below.

- [x] A. As n increases, the binomial distribution becomes more bell shaped.

18) Use n = 6 and p = 0.8 to complete parts (a) through (c) below.

(a) Construct a binomial probability distribution with the given parameters.

x	P(x)
0	.0001
1	.0015
2	.0154
3	.0819
4	.2458
5	.3932
6	.2621

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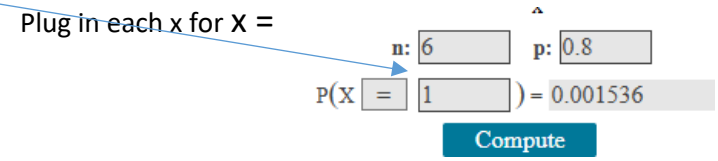
Plug in each x for X =



(b) Compute the mean and standard deviation, using $\mu_X = np$ and $\sigma_X = \sqrt{np(1-p)}$.

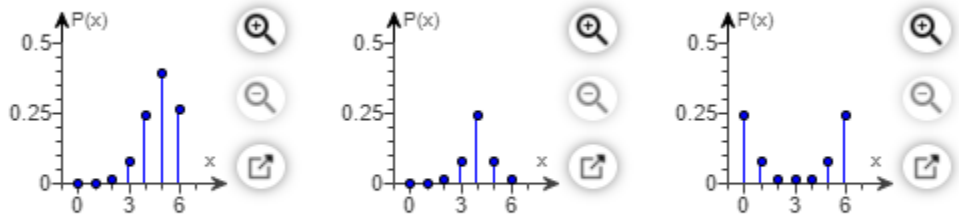
μ_X = 4.8 (Round to two decimal places as needed.)

σ_X = .98 (Round to two decimal places as needed.)

$\mu_x = np$

$\sigma_x = \sqrt{np(1-p)}$

- [x] A.
- [ ] B.



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Use n = 6, and p = 0.35 to complete parts (a) through (c) below.

(a) Find the probabilities and construct a binomial probability distribution with the given parameters.
(b) Compute the mean and standard deviation of the random variable.
(c) Draw the probability histogram, comment on its shape, and label the mean on the histogram

Calculate probability for each x value

n: 6 p: 0.35
P(X = 6) = 0.00183827
Compute

(a) To construct a binomial probability distribution, complete the table to the right.

x	P(x)
0	.0754
1	.2437
2	.328
3	.2355
4	.0951
5	.0205
6	.0018

(Round to four decimal places as needed.)

Calculate probability for each x value

(b) Compute the mean and standard deviation of the random variable.

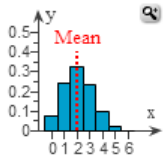
μ_x = 2.1 (Round to one decimal place as needed.)

σ_x = 1.2 (Round to one decimal place as needed.)

$\mu_x = np$

$\sigma_x = \sqrt{np(1-p)}$

(c) Choose the correct answer below.

C. 

The binomial probability distribution is skewed right.

According to a survey, 65% of murders committed last year were cleared by arrest or exceptional means. Fifty murders committed last year are randomly selected, and the number cleared by arrest or exceptional means is recorded.
(a) Find the probability that exactly 40 of the murders were cleared.
(b) Find the probability that between 36 and 38 of the murders, inclusive, were cleared.
(c) Would it be unusual if fewer than 20 of the murders were cleared? Why or why not?

(a) The probability that exactly 40 of the murders were cleared is .0093.
(Round to four decimal places as needed.)

(b) The probability that between 36 and 38 of the murders, inclusive, were cleared is .1535.
(Round to four decimal places as needed.)

(c) Would it be unusual if fewer than 20 of the murders were cleared? Why or why not?

A. No, it would not be unusual because 20 is between $\mu - 2\sigma$ and $\mu + 2\sigma$.

B. Yes, it would be unusual because 20 is between $\mu - 2\sigma$ and $\mu + 2\sigma$.

C. Yes, it would be unusual because 20 is less than $\mu - 2\sigma$.

D. No, it would not be unusual because 20 is less than $\mu - 2\sigma$.

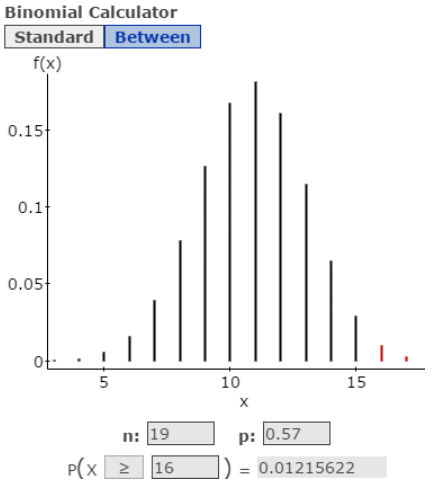
According to a survey, 57% of males between the ages of 18 and 24 lived at home in 2005 (unmarried college students living in dorms are counted as living at home). A survey is administered at a community college to 19 randomly selected male students between the ages 18 and 24 years, and 16 of them respond that they live at home.
(a) Based on the sample of 19 students, what proportion of community college males live at home?
(b) Find the probability that 16 or more out of 19 community college male students live at home assuming that the proportion who live at home is 57%.
(c) What might you conclude from this result?

(a) The proportion of community college males who live at home based on the sample of 19 students is .84. $\frac{16}{19} = 0.84$
(Round to two decimal places as needed.)

(b) The probability that 16 or more out of 19 community college male students live at home, assuming that the proportion who live at home is 57%, is .0122.
(Round to four decimal places as needed.)

(c) What might you conclude from this result?

C. This result is unusual because it is less than 0.05. Community college enrollment appears to be a factor that increases the likelihood of living at home.



According to an almanac, 80% of adult smokers started smoking before turning 18 years old.
(a) Compute the mean and standard deviation of the random variable X, the number of smokers who started before 18 in 400 trials of the probability experiment.
(b) Interpret the mean.
(c) Would it be unusual to observe 360 smokers who started smoking before turning 18 years old in a random sample of 400 adult smokers? Why?

$\mu_x = np$

$\sigma_x = \sqrt{np(1-p)}$

(a) μ_x = 320

σ_x = 8 (Round to the nearest tenth as needed.)

C. It is expected that in a random sample of 400 adult smokers, 320 will have started smoking before turning 18.

(c) Would it be unusual to observe 360 smokers who started smoking before turning 18 years old in a random sample of 400 adult smokers?

A. Yes, because 360 is between $\mu - 2\sigma$ and $\mu + 2\sigma$.

B. Yes, because 360 is greater than $\mu + 2\sigma$.

Suppose that a recent poll found that 51% of adults believe that the overall state of moral value is poor. Complete parts (a) through (c).

(a) For 350 randomly selected adults, compute the mean and standard deviation of the random variable X, the number of adults who believe that the overall state of moral values is poor.

The mean of X is 179. (Round to the nearest whole number as needed.)
The standard deviation of X is 9.4. (Round to the nearest tenth as needed.)

(b) Interpret the mean. Choose the correct answer below.

D. For every 350 adults, the mean is the number of them that would be expected to believe that the overall state of moral values is poor.

(c) Would it be unusual if 179 of the 350 adults surveyed believe that the overall state of moral values is poor?

Yes

No