6.1 Exercise **MATH 241** **THOMPSON**

1) Determine whether the random variable is discrete or continuous. In each case, state the possible values of the random variable.
(a) The number of fish caught during a fishing tournament.
(b) The time it takes to fly from City A to City B.

(a) Is the number of fish caught during a fishing tournament discrete or continuous?

- A. The random variable is continuous. The possible values are $x = 0, 1, 2, \ldots$
- ✔ B. The random variable is discrete. The possible values are $x = 0, 1, 2, \ldots$

(b) Is the time it takes to fly from City A to City B discrete or continuous?

- A. The random variable is continuous. The possible values are $t = 1, 2, 3, \ldots$
- ✔ B. The random variable is continuous. The possible values are $t > 0$.

2) Determine whether the random variable is discrete or continuous. In each case, state the possible values of the random variable.
(a) The number of light bulbs that burn out in the next week in a room with 13 bulbs.
(b) The distance a baseball travels in the air after being hit.

(a) Is the number of light bulbs that burn out in the next week in a room with 13 bulbs discrete or continuous?

- A. The random variable is discrete. The possible values are $0 \le x \le 13$.
- B. The random variable is continuous. The possible values are $0 \le x \le 13$.
- ✔ C. The random variable is discrete. The possible values are $x = 0, 1, 2, \ldots, 13$.

(b) Is the distance a baseball travels in the air after being hit discrete or continuous?

- A. The random variable is discrete. The possible values are $d = 1, 2, 3, \ldots$
- ✔ B. The random variable is continuous. The possible values are $d > 0$.

3) Determine whether the distribution is a discrete probability distribution.

x	P(x)
0	0.13
1	0.29
2	0.11
3	0.26
4	0.21

Is the distribution a discrete probability distribution?

- A. Yes, because the sum of the probabilities is equal to 1.
- ✔ B. Yes, because the sum of the probabilities is equal to 1 and each probability is between 0 and 1, inclusive.

4) Determine whether the distribution is a discrete probability distribution.

x	0	100	200	300	400
P(x)	0	0	0	0	1

Is the distribution a discrete probability distribution?

A. Yes, because the sum of the probabilities is equal to 1 and each probability is between 0 and 1, inclusive.

5) What are the two requirements for a discrete probability distribution?

Choose the correct answer below. Select all that apply.

A. $\sum P(x) = 1$

B. $\sum P(x) = 0$

C. $0 \le P(x) \le 1$

D. $0 < P(x) < 1$

6) Determine the required value of the missing probability to make the distribution a discrete probability distribution.

x	P(x)
3	0.24
4	?
5	0.47
6	0.07

1 - (0.24+0.47+0.07) = 0.22

P(4) = .22 (Type an integer or a decimal.)

7) The following data represent the number of games played in each series of an annual tournament from 1932 to 2003.

x (games played)	4	5	6	7
Frequency	16	11	18	26

Total = 71 then $\frac{16}{71} = .2254$ for each x value

(a) Construct a discrete probability distribution for the random variable x. ------**OR USE STATCRUNCH**-------

x (games played)	P(x)
4	.2254
5	.1549
6	.2535
7	.3662

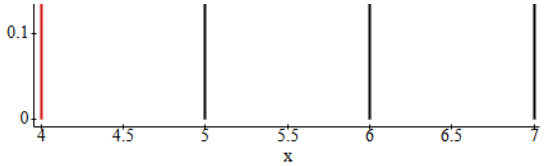
(Round to four decimal places as needed.)

ENTER the table into var1 and var2

STATCRUNCH

STAT – CALC – CUSTOM

Values – X
weights – P(x)
CALCULATE



Plug in each x =

Mean: 5.7605634 Std. Dev.: 1.16842

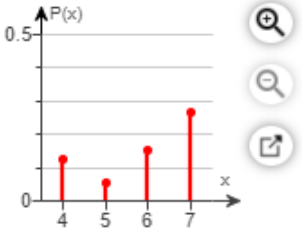
P(X = 4) = 0.22535211

Compute

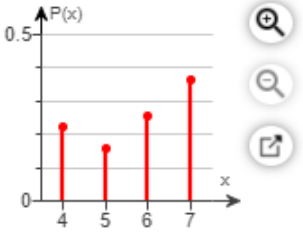
(b) Graph the discrete probability distribution. Choose the correct graph below.

○ A.

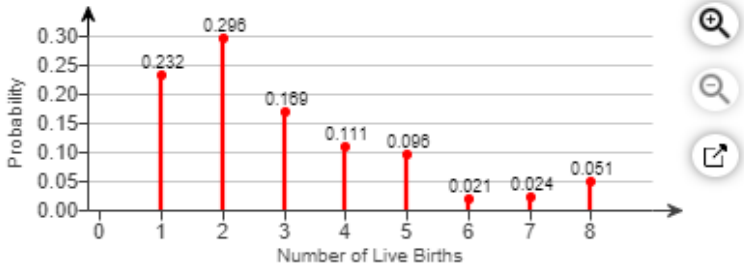
○ B.



✔ C.



8) The graph of the discrete probability to the right represents the number of live births by a mother 45 to 50 years old who had a live birth in 2015. Complete parts (a) through (d) below.



(a) What is the probability that a randomly selected 45- to 50-year-old mother who had a live birth in 2015 has had her fourth live birth in that year?

.111 (Type an integer or a decimal.)

(b) What is the probability that a randomly selected 45- to 50-year-old mother who had a live birth in 2015 has had her fourth or fifth live birth in that year?

.207 (Type an integer or a decimal.)

(c) What is the probability that a randomly selected 45- to 50-year-old mother who had a live birth in 2015 has had her sixth or more live birth in that year?

.096 (Type an integer or a decimal.)

(d) If a 45- to 50-year-old mother who had a live birth in 2015 is randomly selected, how many live births would you expect the mother to have had?

1(0.232) +2(0.296)+3(0.169)+4(0.111)+5(0.096)+6(0.021)+(7(0.024)+8(0.051)

3 (Round to one decimal place as needed.)

9) Suppose the following data represent the ratings (on a scale from 1 to 5) for a certain smart phone game, with 1 representing a poor rating.

Stars	Frequency
1	2898
2	2988
3	3929
4	4682
5	11,024

(a) Construct a discrete probability distribution for the random variable x.

Stars (x)	P(x)
1	.114
2	.117
3	.154
4	.183
5	.432

ENTER COLUMNS INTO STATCRUNCH

var1	var2
1	2898
2	2988
3	3929
4	4682
5	11024

STATCRUNCH

STAT – CALC – CUSTOM

Values – X
weights – P(x)
CALCULATE

Plug in each x value to get P(x)

Mean: 3.7031856 Std. Dev.: 1.4100046

P(X = 1) = 0.11355354

Compute

(b) Compute and interpret the mean of the random variable x.

The mean is 3.7 stars.
(Round to one decimal place as needed.)

Which of the following interpretations of the mean is correct?

C. As the number of experiments increases, the mean of the observations will approach the mean of the random variable.

10) In the probability distribution to the right, the random variable X represents the number of hits a baseball player obtained in a game over the course of a season. Complete parts (a) through (f) below.

x	P(x)
0	0.1664
1	0.3358
2	0.2870
3	0.1481
4	0.0386
5	0.0241

(a) Verify that this is a discrete probability distribution.

This is a discrete probability distribution because all of the probabilities are between 0 and 1, inclusive, and the sum of the probabilities is 1.
(Type whole numbers. Use ascending order.)

(b) Draw a graph of the probability distribution. Describe the shape of the distribution.

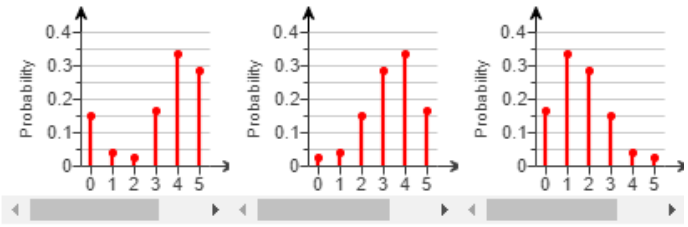
Graph the probability distribution. Choose the correct graph below.

STATCRUNCH

STAT – CALC – CUSTOM

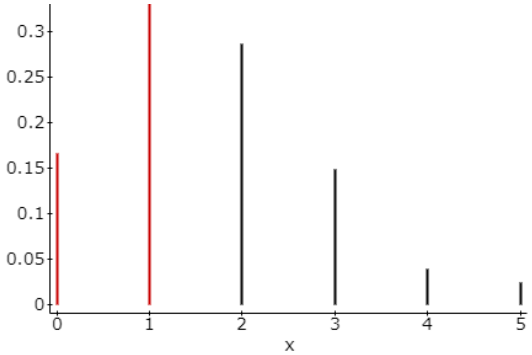
Values – X
weights – P(x)
CALCULATE

A. B. C.



Describe the shape of the distribution.

The distribution has one mode and is skewed right.



Mean: 1.629 Std. Dev.: 1.1760778

P(X ≤ 1) = 0.5022

STATCRUNCH

STAT – CALC – CUSTOM

Values – X
weights – P(x)
CALCULATE

(c) Compute and interpret the mean of the random variable X.

μ_X = 1.629 hits
(Type an integer or a decimal. Do not round.)

Mean: 1.629 Std
P(X ≤ 1) =

Which of the following interpretations of the mean is correct?

Over the course of many games, one would expect the mean number of hits per game to be the mean of the random variable.

(d) Compute the standard deviation of the random variable X.

STATCRUNCH

STAT – CALC – CUSTOM

Values – X
weights – P(x)
CALCULATE

σ_X = 1.176 hits
(Round to three decimal places as needed.)

(e) What is the probability that in a randomly selected game, the player got 2 hits?

.287
(Type an integer or a decimal. Do not round.)

Mean: 1.629 Std. Dev.: 1.1760778
P(X > 1) = 0.4978
Compute

(f) What is the probability that in a randomly selected game, the player got more than 1 hit?

.4978

11) In the probability distribution to the right, the random variable X represents the number of marriages an individual aged 15 years or older has been involved in. Complete parts (a) through (f) below.

x	P(x)
0	0.261
1	0.567
2	0.139
3	0.028
4	0.004
5	0.001

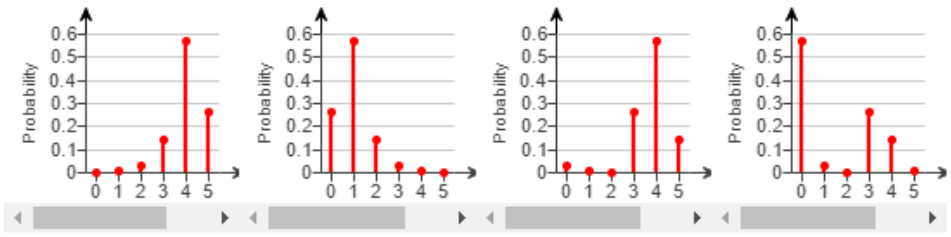
(a) Verify that this is a discrete probability distribution.

This is a discrete probability distribution because all of the probabilities are between 0 and 1, inclusive, and the sum of the probabilities is 1.
(Type whole numbers. Use ascending order.)

(b) Draw a graph of the probability distribution. Describe the shape of the distribution.

Graph the probability distribution. Choose the correct graph below.

A. B. C. D.



Describe the shape of the distribution.

The distribution has one mode and is skewed right.

STATCRUNCH

STAT – CALC – CUSTOM

Values – X
weights – P(x)
CALCULATE

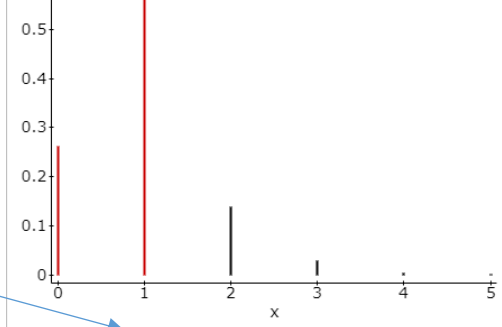
(c) Compute and interpret the mean of the random variable X.

μ_X = .95 marriages

(Type an integer or a decimal. Do not round.)

Which of the following interpretations of the mean is correct?

If many individuals aged 15 year or older were surveyed, one would expect the mean number of marriages to be the mean of the random variable.



Mean: 0.95 Std. Dev.: 0.74933304

P(X ≤ 1) = 0.828

Compute

(d) Compute the standard deviation of the random variable X.

σ_X = .7 marriages

(Round to one decimal place as needed.)

(e) What is the probability that a randomly selected individual 15 years or older was involved in two marriages?

.139

(Type an integer or a decimal. Do not round.)

= 2

(f) What is the probability that a randomly selected individual 15 years or older was involved in at least two marriages?

0.172

at least 2

Mean: 0.95 Std. Dev.: 0.74933304

P(X ≥ 2) = 0.172

Compute

12) The accompanying data represent the ideal number of children for a random sample of 900 adults. through (d) below.

Click the icon to view the data about ideal numbers of children.

x (# of children)	P(x)
0	.011
1	.032
2	.583
3	.271
4	.081
5	.018

STATCRUNCH

STAT – CALC – CUSTOM

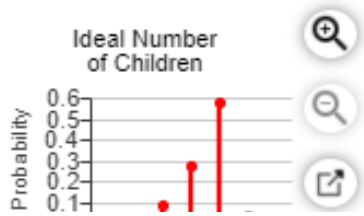
Values – X
weights – P(x)
CALCULATE

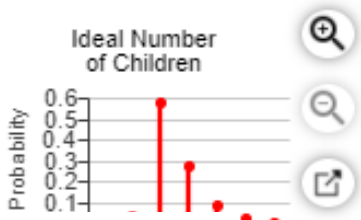
Plug in each x value to get P(x) P(X = 4) =

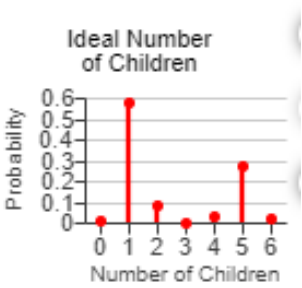
Compu

(b) Draw a graph of the probability distribution. Choose the correct graph below.

A. B. C.







(c) Compute and interpret the mean of the random variable X.

The mean is 2.4 children.

Still from same answer

(Round to one decimal place as needed.)

Mean: 2.4455556 Std. Dev.: 0.82887623

P(X ≤ 2) = 0.62666667

Compute

B. If many adults were surveyed, one would expect the mean ideal number of children to be the mean of the random variable.

C. If any number of adults were surveyed, one would expect the mean ideal number of children to be the mean of the random variable.

D. The observed ideal number of children will be equal to the mean ideal number of children for most adults.

(d) Compute the standard deviation of the random variable X.

The standard deviation is .8 children.
(Round to one decimal place as needed.)

13) Suppose a life insurance company sells a $240,000 one-year term life insurance policy to a 22-year-old female for $350. The probability that the female survives the year is 0.999629. Compute and interpret the expected value of this policy to the insurance company.

The expected value is $ 260.96 .
(Round to two decimal places as needed.)

350 – (240,000 · (1-.999629) = $260.96

Which of the following interpretation of the expected value is correct?

A. The insurance company expects to make an average profit of $23.72 on every 22-year-old female it insures for 1 month.

B. The insurance company expects to make an average profit of $349.87 on every 22-year-old female it insures for 1 year.

C. The insurance company expects to make an average profit of $260.96 on every 22-year-old female it insures for 1 year.

D. The insurance company expects to make an average profit of $31.81 on every 22-year-old female it insures for 1 month.

14) An investment counselor calls with a hot stock tip. He believes that if the economy remains strong, the investment will result in a profit of $40,000. If the economy grows at a moderate pace, the investment will result in a profit of $10,000. However, if the economy goes into recession, the investment will result in a loss of $40,000. You contact an economist who believes there is a 20% probability the economy will remain strong, a 70% probability the economy will grow at a moderate pace, and a 10% probability the economy will slip into recession. What is the expected profit from this investment?

The expected profit is $ 11000 . (Type an integer or a decimal.) 40000(.2)+10000(.7) - 40000(.1) = 11000

15) In the game of roulette, a player can place a $8 bet on the number 24 and have a $\frac{1}{38}$ probability of winning. If the metal ball lands on 24, the player gets to keep the $8 paid to play the game and the player is awarded an additional $280. Otherwise, the player is awarded nothing and the casino takes the player's $8. What is the expected value of the game to the player? If you played the game 1000 times, how much would you expect to lose?

The expected value is $ – .42 .
(Round to the nearest cent as needed.)

$280 \cdot (\frac{1}{38}) - 8(\frac{37}{38})$ = - 0.42

The player would expect to lose about $ 421.05 .
(Round to the nearest cent as needed.)

multiply by 1000 $421.05

16) For a multistate lottery, the following probability distribution represents the cash prizes of the lottery with their corresponding probabilities. Complete parts (a) through (c) below.

x (cash prize, $)	P(x)
Grand prize	0.00000000658
200,000	0.00000032
10,000	0.000001812
100	0.000145222
7	0.004824378
4	0.006550251
3	0.01109557
0	0.97738244042

part a is the mean

(a) If the grand prize is $14,000,000, find and interpret the expected cash prize. If a ticket costs $1, what is your expected profit from one ticket?

The expected cash prize is $ .28 . (Round to the nearest cent as needed.)

What is the correct interpretation of the expected cash prize?

If you played the lottery many times on average you would win the expected cash price per lottery ticket.

The expected profit from one $1 ticket is $ −0.72 . 1 - .28

(b) To the nearest million, how much should the grand prize be so that you can expect a profit?
$ 124,000,000

This suggests a wide range of payouts

STATCRUNCH

GRAPH – SCATTER PLOT

Values – X
weights – Y
CALCULATE

(c) Make a new column **excluding** the 1st row

x (cash prize, $	P(x)	var3	var4
14000000	6.58e-9	200000	3.2e-7
200000	3.2e-7	10000	0.000001812
10000	0.000001812	100	0.000145222
100	0.000145222	7	0.004824378
7	0.004824378	4	0.006550251
4	0.006550251	3	0.01109557
3	0.01109557	0	0.97738244
0	0.97738244		

Mean: 0.18990056 Std. Dev.: 113.94322

P(X ≤ 0) = 0.97738245

$$\frac{(1-\mu)}{P(x)\ of\ row\ 1} = \frac{(1-.1899)}{.00000000658}$$

number in top right of original problem

124,000,000

*round up

This suggests a wide range of payouts

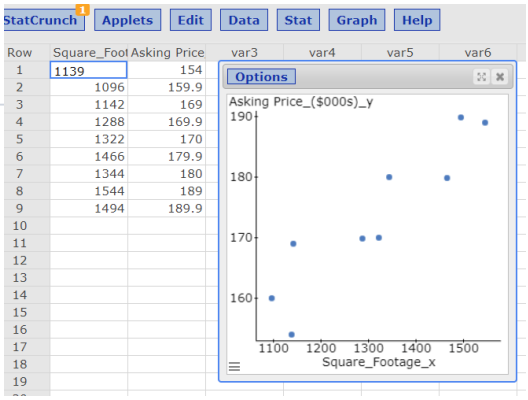
(d) **No, because your chance of winning is determined by the properties of the lottery, with no payouts.**

EXTRA

One of the biggest factors in determining the value of a home is the square footage. The accompanying data represent the square footage and asking price (in thousands of dollars) for a random sample of homes for sale. Complete parts (a through (h).

Click the icon to view the data table.

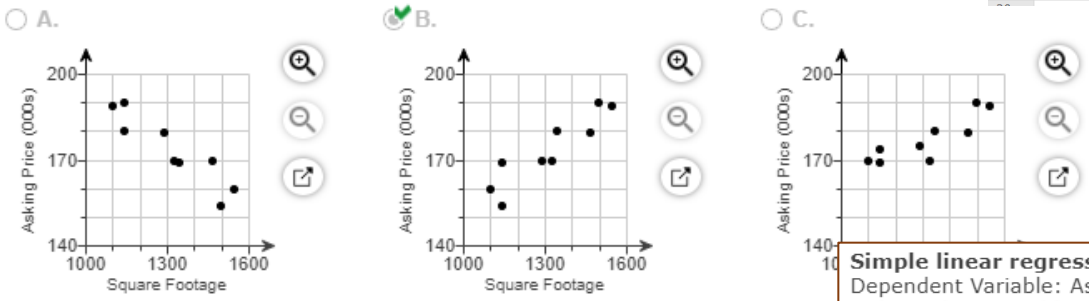
Click the icon to view a table of critical values for the correlation coefficient.



(a) Which variable is the explanatory variable?

- A. Square footage
- B. Determining the value of a home
- C. Number of homes
- D. Asking price

(b) Draw a scatter diagram of the data. Choose the correct graph below.



(c) Determine the linear correlation coefficient between square footage and asking price

Simple linear regression results:
Dependent Variable: Asking Price_($000s)_y
Independent Variable: Square_Footage_x
Asking Price_($000s)_y = 83.527257 + 0.068428787 Square
Sample size: 9
R (correlation coefficient) = 0.92063401
R-sq = 0.84756697
Estimate of error standard deviation: 5.1184607

The linear correlation coefficient between square footage and asking price is r = .921.
(Round to three decimal places as needed.)

(d) Is there a linear relation between the square footage and asking price?

- Yes
- No

(e) Find the least-squares regression line treating square footage as the explanatory variable. Choose the correct answer below.

- A. The least-squares regression line is $\hat{y} = 83.53x - 0.06843$.
- B. The least-squares regression line is $\hat{y} = -0.06843x + 83.53$.
- C. The least-squares regression line is $\hat{y} = 0.06843x + 83.53$.
- D. The least-squares regression line is $\hat{y} = 83.53x + 0.06843$.

(f) Interpret the slope. Choose the correct answer below.

For each square foot added to the area, the expected asking price of the house will increase by $68.43.

(g) Is it reasonable to interpret the y-intercept. No

(h) One home that is 1.094 square feet is listed at $189,900. Is this home's price above or below average for a home of this size?

Above average

May there be some reasons for this price?

Yes