

Name _____

Probability Distributions

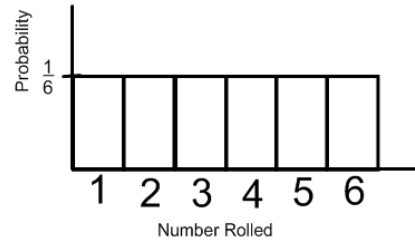
A random variable is a variable whose value is determined by the outcomes of a random event. For example, when you roll a six-sided die, you can define a random variable X that represents the number showing on the die. So, the possible values of X are 1, 2, 3, 4, 5, and 6. For every random variable, a *probability distribution* can be defined.

A histogram of this table would look like this:

Probability Distributions

A **probability distribution** is a function that gives the probability of each possible value of a random variable. The sum of all the probabilities in a probability distribution must equal 1.

Probability Distribution for Rolling a Die						
X	1	2	3	4	5	6
$P(X)$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$

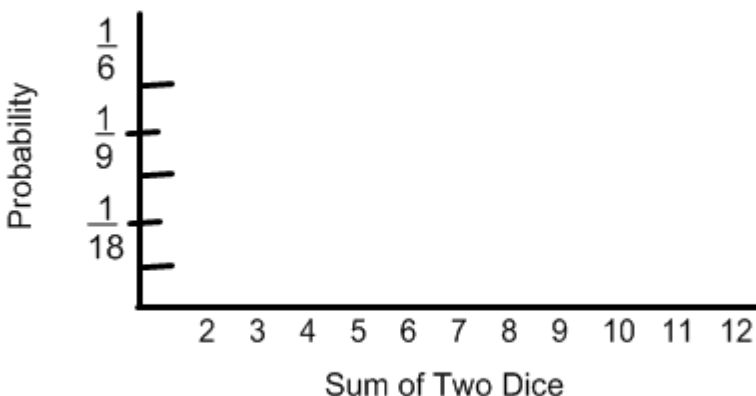


1. Two 6-sided dice are tossed. Let X be a random variable that represents the sum of the two dice. Complete the table showing the sum of the two dice.

Sum	1	2	3	4	5	6
1						
2						
3						
4						
5						
6						

Make a table and a histogram showing the probability distribution for X .

$X(\text{sum})$	2	3	4	5	6	7	8	9	10	11	12
# outcomes											
$P(X)$											



a. what is the most likely sum when rolling two six-sided dice?

b. What is the probability that the sum of the two dice is at least 10?

2. Four coins are flipped. Complete the tree/table showing the possible outcomes.

Coin 1	Coin 2	Coin 3	Coin 4	Result	
H	H	H	H	HHHH	
		H	T	HHHT	
	T	T			
T					
	T				

Complete the probability distribution table and make a histogram.

# Heads	0	1	2	3	4
# outcomes					
P(X)					

Histogram: (Be sure to accurately number and LABEL.)

- What is the most likely outcome of tossing 4 coins?
- What is the probability that at least 2 heads are tossed?

3. Let X be a random variable that represents the sum when two four-sided dice are rolled. Complete the table showing the sums possible. Make a table and histogram showing the probability distribution for x .

Sum	1	2	3	4
1				
2				
3				
4				

X(sum)	2	3	4	5	6	7	8
# outcomes							
P(X)							

Histogram: (Be sure to accurately number and LABEL.)

- a. What is the most likely outcome of rolling the two dice?
- b. What is the probability that the sum of the two dice is at most 4? Explain/show work.

4. Let X be the letter on a block chosen randomly from a bag. The bag contains 7 blocks labeled "A," 3 blocks labeled "B," 6 blocks labeled "C," and 5 blocks labeled "D."

X(letter)	A	B	C	D
# outcomes				
P(X)				

Histogram: (Be sure to accurately number and LABEL.)

BINOMIAL DISTRIBUTIONS One type of probability distribution is a **binomial distribution**. A binomial distribution shows the probabilities of the outcomes of a *binomial experiment*.

Binomial Experiments

A **binomial experiment** meets the following conditions:

- There are n independent trials.
- Each trial has only two possible outcomes: success and failure.
- The probability of success is the same for each trial. This probability is denoted by p . The probability of failure is given by $1 - p$.

For a binomial experiment, the probability of exactly k successes in n trials is:

$$P(k \text{ successes}) = {}_n C_k p^k (1 - p)^{n - k}$$

5. A survey taken at your school found that 68% of the students are not afraid to fly. Suppose you randomly survey 5 students. Draw a histogram of the binomial distribution for your survey.

The probability that a randomly selected student is not afraid to fly is $p = \underline{\hspace{2cm}}$. Because you survey 5 students, $n = \underline{\hspace{2cm}}$.

$P(k = 0) = \underline{\hspace{4cm}} \approx \underline{\hspace{2cm}}$

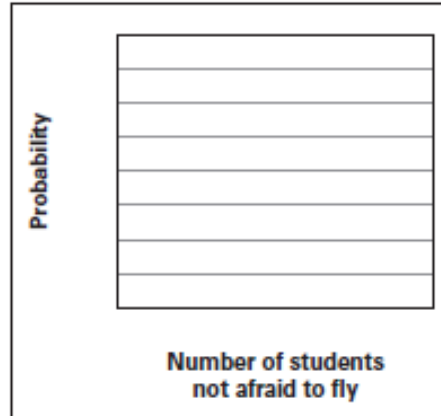
$P(k = 1) = \underline{\hspace{4cm}} \approx \underline{\hspace{2cm}}$

$P(k = 2) = \underline{\hspace{4cm}} \approx \underline{\hspace{2cm}}$

$P(k = 3) = \underline{\hspace{4cm}} \approx \underline{\hspace{2cm}}$

$P(k = 4) = \underline{\hspace{4cm}} \approx \underline{\hspace{2cm}}$

$P(k = 5) = \underline{\hspace{4cm}} \approx \underline{\hspace{2cm}}$



a. What is the most likely outcome of the survey?

b. What is the probability that at least 3 students are not afraid to fly?