

Name: \_\_\_\_\_

Spring 2016

P. Walston/A. Moore

# AFM UNIT 1: Probability

Topic	worksheet	# assigned	#completed	Teacher's Signature
Tree Diagrams	1-0	13		
FCP	1-1	16		
Combinations/ Permutations	1-2	22		
Factorials	1-3	20		
Intro to Probability	1-4	17		
More Probability	1-5	22		
Probability Distribution	1-6	9		
Binomial Theorem	1-7	26		
Binomial Probability	1-8	8		
		TOTAL Assigned  153	TOTAL Completed	HOMEWORK GRADE (#done/#com x 100=)

# AFM Unit 1 Probability Homework Packet

Name: \_\_\_\_\_ Date: \_\_\_\_\_

## Travel Time

A travel agent plans trips for tourists from Chicago to Miami. He gives them three ways to get from town to town: airplane, bus, train. Once the tourists arrive, there are two ways to get to the hotel: hotel van or taxi. The cost of each type of transportation is given in the table below.

Transportation Type	Cost
Airplane	\$350
Bus	\$150
Train	\$225
Hotel Van	\$60
Taxi	\$40

1. Draw a tree diagram to illustrate the possible choices for the tourists. Determine the cost for each outcome.
  
2. If these six outcomes are chosen equally by tourists, what is the probability that a randomly selected tourist travel in a bus?
3. What is the probability that a person's trip cost less than \$300?
4. What is the probability that a person's trip costs more than \$350?
5. If the tourists were flying to New York, the subway would be a third way to get to the hotel. How would this change the number of outcomes? Use the Fundamental Counting Principle to explain your answer.

Name: \_\_\_\_\_ Date: \_\_\_\_\_

### “Happy Birthday to You”

Andy has asked his girlfriend to make all the decisions for their date on her birthday. She will pick a restaurant and an activity for the date. Andy will choose a gift for her. The local restaurants include Mexican, Chinese, Seafood, and Italian. The activities she can choose from are Putt-Putt, bowling, and movies. Andy will buy her either candy or flowers.



1. How many outcomes are there for these three decisions? \_\_\_\_\_
2. Draw a tree diagram to illustrate the choices.

Dinner for Two	Activity Cost for Two	Gift Cost
Mexican - \$20	Putt-Putt - \$14	Flowers - \$25
Chinese - \$25	Bowling - \$10	Candy - \$7
Italian - \$15	Movies - \$20	

3. If all the possible outcomes are equally likely, what is the probability that the date will cost at least \$50?
4. What is the maximum cost for the date?
5. What is the minimum cost for the date?
6. To the nearest dollar, what is the average cost for this date?
7. What is the probability that the date costs exactly \$60?
8. What is the probability that the date costs under \$40?

**AFM Worksheet**  
**1-1 FPC and Permutations**

Name \_\_\_\_\_  
Date \_\_\_\_\_ Period \_\_\_\_\_

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For problems 1 and 2, you *must* draw boxes for each problem.

1. a) How many possible seven-digit phone numbers are there?  
  
b) How many seven-digit phone numbers are there that begin with the prefix 772?  
  
c) How many seven-digit phone numbers are there that begin with the prefix 772 and none of the last four digits repeat?  
  
d) What is the **probability** that a randomly selected phone number with the prefix 772, has none of its last four digits repeating?
  
2. Give the number of possible arrangements or selections for each situation.
  - a) Arrangements of six poetry books on a shelf
  
  - b) Arrangements of seven students seated in the front row of a classroom
  
  - c) License plates with two letters followed by four digits.
  
  - d) License plates with two letters followed by four digits, or four digits followed by two letters.
  
  - e) Outfits made up of a shirt, a pair of slacks, and a sweater, selected from five shirts, four pairs of slacks, and three sweaters.

f) Restaurant meals formed by selecting an appetizer, a salad, a main course, and four choices of dessert.

g) Seven-digit telephone numbers, if the first digit cannot be zero.

3. In Ms. Scarpino's math class, there are six desks in each row. On the first day of the semester, she tells her students that they may sit anywhere they want, but that they must sit in the same row every day.

a) If the first row is completely filled, in how many different ways can the students who have chosen to sit there be seated?

b) What is the probability that the students in the front row will be seated in alphabetical order by their first name?

c) What is the probability that among the students in the front row, the tallest student will sit in the chair farthest to the right?

d) On April Fool's Day, the students came to class and found that two of the desks in the front row were missing. In how many ways could the students who usually sit in the front row choose the remaining desks?

e) On April Fool's Day, what is the probability that Ricardo, one of the students who usually sits in the front row, was able to get a seat in this row?

**AFM Worksheet**  
**1-2 Combinations**

Name \_\_\_\_\_  
Date \_\_\_\_\_ Period \_\_\_\_\_

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Evaluate each expression.

1. a)  ${}_6C_3 =$  \_\_\_\_\_      b)  ${}_8C_7 =$  \_\_\_\_\_      c)  ${}_{24}C_3 =$  \_\_\_\_\_      d)  ${}_{15}C_3 =$  \_\_\_\_\_  
e)  ${}_{12}C_6 =$  \_\_\_\_\_      f)  ${}_{20}C_1 =$  \_\_\_\_\_      g)  ${}_{20}C_{19} =$  \_\_\_\_\_      h)  ${}_{20}C_{20} =$  \_\_\_\_\_

2. Find the number of ways of making each choice.

- a) Selecting a 4-member committee from a 20-member club.
- b) Selecting a 4-member committee from a 20-member club if the president of the club must be on the committee.
- c) Selecting a 4-member committee from a 20-member club if the president of the club cannot be on the committee but the treasurer must be on the committee.
- d) Selecting a 4-member committee from a 20-member club if there are 12 women and 8 men in the club and the committee must include 2 men and 2 women.
- e) Selecting three days out of a week.
- f) Selecting three days out of a week if exactly two of them must be weekdays.

3. The Debate Club wants to create a 4-person committee (i.e., no officers) from its membership of 30 people.

- a) How many different committees are possible?
  
- b) Carlos is a member of the Debate Club. How many different committees are possible that have Carlos as a committee member?
  
- c) What's the **probability** that Carlos will be on a committee consisting of randomly selected members?

4. There are 10 fourth-graders, 12 fifth-graders, and 8 sixth-graders in a Girl Scout troop. Mrs. Sullivan, the troop leader, needs five girls to serve on the troop's camping committee. To make the selection fair, she lets the girls draw names out of a hat to fill the five places on the committee.

- a) How many different committees are possible?
  
- b) What is the probability that Lisa, one of the sixth-grade scouts, will be on the committee?
  
- c) What is the probability that Lisa and her best friend Naomi will both be on the committee?
  
- d) What is the probability that all the committee members will be fifth-graders?
  
- e) What is the probability that the committee will be made up of 2 fourth-graders, 2 fifth-graders, and 1 sixth-grader?

AFM  
1-3 Factorial Notation

Name \_\_\_\_\_  
Date \_\_\_\_\_  
Block \_\_\_\_\_

Simplify – No calculator allowed. You must show your work.

1.  $\frac{6!}{4!}$

2.  $\frac{8!}{0!}$

3.  $\frac{10!}{12!}$

4.  $\frac{3!4!}{6!}$

5.  $3!2!$

6.  $(3!)!$

7.  $\frac{(n-2)!}{(n+1)!}$

8.  $\frac{n!}{(n-2)!}$

9.  $\frac{n!(n-1)!}{(n+1)!(n-2)!}$

10.  $\frac{(n+3)!}{(n+1)!}$

Write in factorial form.

11.  $(10 \cdot 9 \cdot 8 \cdot 7)$

12.  $93 \cdot 92 \cdot 91$

13.  $19 \cdot 18 \cdot 17 \cdot 16 \cdot 15 \cdot 14 \cdot 13$

14.  $85 \cdot 84 \cdot 83$

15.  $20 \cdot 19 \cdot 18 \cdot 9 \cdot 8 \cdot 7$

16.  $16 \cdot 15 \cdot 49 \cdot 48$

17.  $\frac{50 \cdot 49 \cdot 48 \cdot 47}{5!}$

18.  $\frac{63 \cdot 62 \cdot 61}{10 \cdot 9 \cdot 8}$

19.  $\frac{100 \cdot 99 \cdot 98}{1 \cdot 2 \cdot 3}$

20.  $\frac{16 \cdot 15 \cdot 14 \cdot 13}{20!}$



*Express each probability to three decimal places.*

1) A six-sided die is rolled.

a) What's the probability of rolling a two ?

b) What's the probability of rolling a five?

c) What's the probability of rolling a two OR a five?

2) The following (incomplete) table shows a random sample of 100 hikers and the areas of hiking they prefer:

	Coastline	Near lakes and streams	On mountain peaks	Totals
Male	18	16		45
Female			14	55
Totals		41		

a) Complete the table.

b) What's the probability that a hiker is a female?

c) What's the probability a male hiker prefers to hike on mountain peaks?

d) What's the probability that a coastline hiker is a female?

3) If a meteorologist says there is a 35% **chance** of snow tomorrow, what is the **probability** that it will not snow?

4) If you roll a die once, what is the probability that you will get higher than a 2?

5) A national survey was taken measuring the highest level of educational achievement among adults age 30 and over. The results are shown in the table below.

Highest level of education	Women	Men	Total
8th grade or less	35	46	81
High school graduate	232	305	537
Some college	419	374	793
Bachelor's degree	539	463	1002
Graduate or professional degree	377	382	759
Total	1602	1570	3172

What is the probability that:

- a randomly chosen person from the survey group is a man?
- the highest level of education completed by a randomly chosen person from the survey group is a bachelor's degree?
- a randomly chosen woman has earned a bachelor's or graduate degree?
- a randomly chosen person whose highest level of education is high school is a man?

6) Suppose a bag contains five green marbles, three blue marbles, six yellow marbles, and four white marbles. Maria shakes up the bag to mix the marbles and then draws one marble out of the bag. What is the probability that the marble Maria draws is:

- blue
- white
- green or yellow
- neither blue nor yellow

1) A bag contains 7 blue marbles, 3 green marbles, and 5 yellow marbles. Suppose you draw two marbles at random. What is the probability that you draw:

a) a blue marble, then a green marble?

With replacement

Without replacement

b) two yellow marbles?

With replacement

Without replacement

c) a blue marble and a green marble *in any order*? (Careful, this one's tricky.)

With replacement

Without replacement

2) Suppose you randomly draw a single card from a standard deck of cards.

a) What's the probability you will draw a six of diamonds?

b) What's the probability you will draw a club?

c) What's the probability you will draw a face card?

d) What's the probability you will draw a red card?

3) Suppose you randomly draw two cards from a standard deck of playing cards. What's the probability of drawing a four of clubs, and then drawing a seven of hearts?

With replacement

Without replacement

4) You randomly draw two cards from a standard deck of playing cards. What's the probability of drawing two black cards?

With replacement

Without replacement

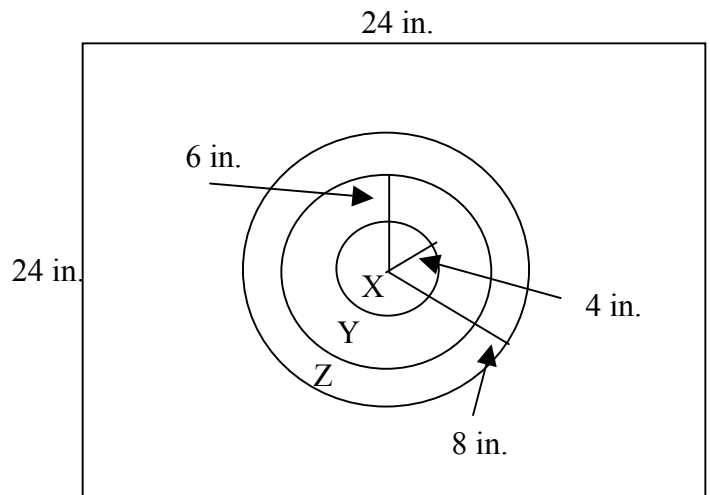
5) Suppose you have a dart board hanging on a wall.

If you throw a dart randomly at the wall, and assuming your dart lands somewhere on the wall, what is the probability that your dart will land:

a) in region X

b) in region Y

c) in region Z



6) What is the probability of rolling a sum of 5 with two dice?

7) In a two dice experiment, where one die is red and the other is green...

a) Find the probability of rolling a sum of at least 9.

b) Find the probability of rolling a sum of no greater than 5.

c) Find the probability of rolling two numbers whose difference is 1.

d) Find the probability of rolling a 3 or a 4 on the green die.

The following table is a valid probability distribution for a random variable  $X$ . What must be the value for  $P(2)$  to complete the table?

$X$	$P(x)$
0	0.15
1	0.2
2	?
3	0.4

A. 0.15

C. 0.25

B. 0.2

D. 0.3

2. A random variable  $X$  is defined as the number of heads observed when a coin is tossed 4 times. The probability distribution for this random variable is shown below.

$X$	0	1	2	3	4
$P(x)$	$\frac{1}{16}$	$\frac{4}{16}$	$\frac{6}{16}$	$\frac{4}{16}$	$\frac{1}{16}$

Which of the following statements is not true?

A. The probability of no heads is the same as the probability of 4 heads

B. The most likely outcome is 2 heads

C. The expected value is  $\frac{6}{16}$ 

D. The probability of not tossing 2 heads is greater than the probability of tossing 2 heads.

3. What is the expected value for a single roll of a 6-sided die?

A. 3.5

C. 4

B. 3

D.  $\frac{1}{6}$ 

4. A student is preparing a probability distribution as shown below.

$X$	$P(x)$
0	0.3
1	0.3
2	0.3
3	?
4	0.3

A value is needed for  $P(3)$  to complete the table. Which statement below is true?

a. The required value for  $P(3)$  is 0.3.b. The required value for  $P(3)$  is 0.2.

c. The required value for  $P(3)$  is  $-0.2$

d. There is no possible value for  $P(3)$  that can make this a valid probability distribution.

5. Calculate the expected value for the given probability distribution.

X	P(x)
6	0.15
8	0.35
10	0.5

6. The owner of a self-serve car wash conducted a study to see how long his customers took. The times in the table below are rounded to the nearest 5 minutes. Based on the experimental probability from the table, calculate the expected value for the time that a customer takes.

<b>Time</b>	10	15	20	25	30	35	40
<b>Frequency</b>	2	6	18	16	10	7	1

7. Students were asked how many MP3 players they own. Construct a probability distribution, graph distribution, and find the expected value.

Players, x	Frequency	P(x)
0	9	
1	17	
2	9	
3	5	
4	2	

8. A sample of high school students were asked how many days they ate breakfast last week. Construct a probability distribution, graph distribution, and find the expected value.

Days, $x$	Frequency	$P(x)$
0	5	
1	3	
2	17	
3	27	
4	6	
5	19	
6	18	
7	65	

9. A school hosts an annual fundraiser where raffle tickets are sold for baked goods, the values that are indicated below. Suppose 100 tickets were sold for a drawing for each of the four cakes.



Gain, $x$					
$P(x)$					

What is the expected value of a participant's net gain if he or she buys a ticket for \$1?  
Graph distribution.



# 1-7 Skills Practice

## *The Binomial Theorem*

Evaluate each expression.

1.  $8!$

2.  $10!$

3.  $12!$

4.  $\frac{15!}{13!}$

5.  $\frac{6!}{3!}$

6.  $\frac{10!}{2!8!}$

7.  $\frac{9!}{3!6!}$

8.  $\frac{20!}{15!5!}$

Expand each power.

9.  $(x - y)^3$

10.  $(a + b)^5$

12.  $(m + 1)^4$

11.  $(g - h)^4$

13.  $(r + 4)^3$

14.  $(a - 5)^4$

15.  $(y - 7)^3$

16.  $(d + 2)^5$

17.  $(x - 1)^4$

18.  $(2a + b)^4$

19.  $(c - 4d)^3$

20.  $(2a + 3)^3$

Find the indicated term of each expansion.

21. fourth term of  $(m + n)^{10}$

22. seventh term of  $(x - y)^8$

23. third term of  $(b + 6)^5$

24. sixth term of  $(s - 2)^9$

25. fifth term of  $(2a + 3)^6$

26. second term of  $(3x - y)^7$

**AFM 1-8 Homework**

1. Use the binomial expression  $(p + q)^n$  to calculate and graph a binomial distribution with  $n = 5$  and  $p = 0.3$ .
  
2. You are hired to monitor quality control for a clothes manufacturer. The manufacturer claims that only 5% of jeans manufactured have a defect.
  - a. Using the manufacturer's claim, write  $P(\text{no defect})$  and  $P(\text{defect})$  as decimals.
  - b. At a checkpoint, you choose six pairs of jeans at random and determine that two pairs have a defect. Find the probability of this happening by chance, using the probabilities you wrote in part **a**.
  - c. Using your results from part **b**, do you believe the manufacturer's claim about quality control? Explain.
  
3. A survey of high school juniors found that 82% of students plan on attending college. If you pick three students at random, what is the probability that at least two plan on attending college? Round to the nearest percent.
  
4. A poll shows that 81% of voters in a city favor an initiative to increase spending on public schools. If 10 voters are selected at random, what is the probability that exactly five of them will vote in favor of the initiative?
  
5. According to one study, 61% of the population swallow at least one spider per year in their sleep. Based on this study, what is the probability that exactly 7 of 10 randomly selected people have swallowed at least one spider in their sleep in the last year?

**Use the Binomial Theorem to find the binomial expansion of the expression.**

6.  $(s - 5v)^5$
  
7.  $(d - 5)^6$
  
8.  $(d + 3)^7$