Teacher

AP/Honors Stat
Worksheet - Probability

Suppose you toss a coin and roll a die.

1. Use a principle you've learned to determine how many outcomes there are.

$2 \times 6 = 12$

2. List the outcomes in the sample space.

H1	H4	T1	T4
H2	H5	T2	T5
H3	H6	T3	T6

3. Find the probability of getting a head and an even number.

$3/12 = 1/4$ or $\frac{1}{2} \cdot \frac{3}{6} = \frac{1}{4}$

4. Find the probability of getting a head.

$\frac{1}{2}$

5. Find the probability of getting a 1, 2, or 3 on the die.

$\frac{1}{2}$

6. Suppose a person was having two surgeries performed at the same time by different operating teams. Assume (unrealistically) that the two operations are independent. If the chances of success for surgery A are 85%, and the chances of success for surgery B are 90%, what are the chances that both will fail? $.15 \cdot .10$

$A^c = .15$
$B^c = .10$

$P(A^c \text{ and } B^c) = .15 \times .1 = .015$

7. If a single die is rolled one time, find the probabilities of getting

(a) a 4 $= \frac{1}{6}$

(b) an even number $1/2$

(c) a number greater than 4 $2/6 = 1/3$

(d) a number less than 7 1

(e) a number greater than 0 1

(f) a number greater than 3 or an odd number $P(x>3 \text{ or odd})$
$\frac{3}{6} + \frac{3}{6} - \frac{1}{6} = \frac{5}{6}$

one roll

(g) a number greater than 3 and an odd number

$\Rightarrow$ not indep

$P(x > 3 \text{ and odd})$
$x > 3 \cap \text{odd} \Rightarrow \frac{1}{6}$

8. Abby, Barbara, Carla, Dan, and Emmett work in a firm's public relations office. Their employer must choose two of them to attend a conference in Chicago. To avoid unfairness, the choice will be made by drawing two names from a hat. (This is a sample size of 2.)

(a) Write down all possible choices of two of the five names. For convenience, you can simply use the first letter of their names.

AB BC CD DE
AC BD CE
AD BE
AE

$_5C_2 = 10$

(b) The random drawing makes all choices equally likely. What is the probability of each choice?

$\frac{1}{10}$

(c) What is the probability that neither of the two men (Dan and Ennis) is chosen?

$\frac{3}{10}$ $\quad \frac{_3C_2}{_5C_2} = \frac{3}{10}$

9. A couple plans to have three children. Find the probability that the children are

(a) all boys $\frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{8}$

(b) all girls $\frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{8}$

(c) exactly two boys or exactly two girls

BBG GGB
GBB or GBG
BGB BGG

$\frac{1}{8} \cdot 3 + \frac{1}{8} \cdot 3 \quad \frac{3}{8} + \frac{3}{8} = \frac{6}{8} = \frac{3}{4}$

(d) at least one child of each sex.

BBG
BGG

$1 - (3B) - (3B)$
$1 - \frac{1}{8} - \frac{1}{8} = \frac{6}{8} = \frac{3}{4}$

10. In a statistics class there are 18 juniors and 10 seniors; 6 of the seniors are females, and 12 of the juniors are males. If a student is selected at random, find the probability of selecting

28 tot

6F 4M → 10 S
18 → 12M 6F

(a) a junior or a female

$\frac{18}{28} + \frac{12}{28} - \frac{6}{28} = \frac{24}{28} = \frac{12}{14} = \frac{6}{7}$

(b) a senior or a female

22 − 6 = 16

$\frac{10}{28} + \frac{12}{28} - \frac{6}{28} = \frac{16}{28} = \frac{8}{14} = \frac{4}{7}$

(c) not a junior male

$1 - \frac{12}{28} \quad \frac{28}{28} - \frac{12}{28} = \frac{16}{28} = \frac{4}{7}$

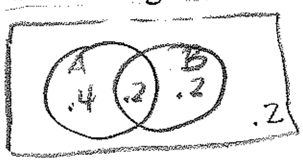
11. Consolidated Builders has bid on two large construction contracts. The company president believes that the probability of winning the first contract (event A) is 0.6, that the probability of winning a second (event B) is 0.4, and that the probability of winning both jobs is 0.2.

(a) What is the probability of the event {A or B} that Consolidated will win at least one of the jobs?

$P(A) + P(B) - P(AB)$

$.6 + .4 - .2 = .8$

(b) Draw a Venn diagram that shows the relation between the events A and B in (a).



12. Write each of the following events in terms of A, B, A^c, and B^c. Indicate these events on the Venn diagram, and use the information above to calculate the probability of each.

(a) Consolidated wins both jobs.

$P(A \cap B) = .2$

(b) Consolidated wins the first job but not the second.

$P(A \cap B^c) = .4$

(c) Consolidated does not win the first job but does win the second.

$P(A^c \cap B) = .2$

(d) Consolidated does not win either job.

$P(A^c \cap B^c) = .2$

TEACHER

1. A recent survey asked 100 randomly selected adult Americans if they thought that women should be allowed to go into combat situations. Here are the results:

Gender	Yes	No	
Male	32	18	50
Female	8	42	50
	40	60	100

(a) Find the probability of a "Yes" answer, given that the person was a female.

8/50

(b) Find the probability that the respondent was a male, given that the response was a "No."

18/50

2. Toss two balanced coins. Let A = head on the first toss, and let B = both tosses have the same outcome. Are events A and B independent? Explain your reasoning clearly.

$P(B|A) = P(B)$

A = H First
B = same Both
$\frac{1}{2} \cdot \frac{1}{2}$

HT
HH
TH
TT

$P(A \cap B) = P(A) \cdot P(B)$
$\frac{1}{2} \cdot \frac{1}{2}$

$P(A) = \frac{2}{4} = \frac{1}{2}$
$P(B) = \frac{2}{4} = \frac{1}{2}$

$\frac{1}{4} = \frac{1}{4}$ yes, they are independent

3. Parking for students at Central High School is very limited, and those who arrive late have to park illegally and take their chances at getting a ticket. Joey has determined that the probability that he has to park illegally and that he gets a parking ticket is 0.07. He recorded data last year and found that because of his perpetual tardiness, the probability that he will have to park illegally is 0.25. Suppose that Joey arrived late once again this morning and had to park in a no-parking zone. Can you find the probability that Joey will get a parking ticket? If so, do it. If you need additional information to find the probability, explain what is needed.

$P(IT) = .07$
$P(I) = .25$

Conditional $\frac{P(T \cap I)}{P(I)} = \frac{.07}{.25} = .28$

4. Two cards are dealt, one after the other, from a shuffled 52-card deck. Why is it wrong to say that the probability of getting two red cards is (1/2)(1/2) = 1/4? What is the correct probability of this event?

$\frac{1}{2} \cdot \left(\frac{25}{51}\right) = \frac{25}{102} \neq \frac{1}{4}$

5. In building new homes, a contractor finds that the probability of a homebuyer selecting a two-car garage is 0.70 and of selecting a one-car garage is 0.20. (Note that the builder will not build a three-car or larger garage.)

(a) What is the probability that the buyer will select either a one-car or a two-car garage?

$\boxed{.7 \quad .2 \quad .1}$

$.7 + .2 = .9$

(b) Find the probability that the buyer will select no garage.

$.1$

(c) Find the probability that the buyer will not want a two-car garage.

$1 - .7 = .3$ OR $P(0) + P(1)$

$.1 + .2 = .3$

6. Researchers are interested in the relationship between cigarette smoking and lung cancer. Suppose an adult male is randomly selected from a particular population. Assume that the following table shows some probabilities involving the compound event that the individual does or does not smoke and the person is or is not diagnosed with cancer:

Event	Probability
smokes and gets cancer	0.08
smokes and does not get cancer	0.17
does not smoke and gets cancer	0.04
does not smoke and does not get cancer	0.71

Suppose further that the probability that the randomly selected individual is a smoker is 0.25.

(a) Find the probability that the individual gets cancer, given that he is a smoker.

Conditional $P(C|S) = \frac{P(C+S)}{P(S)} = \frac{.08}{.25} = .32$

(b) Find the probability that the individual does not get cancer, given that he is a smoker.

$P(NC|S) = \frac{P(NC+S)}{P(S)} = \frac{.17}{.25} = .68$

(c) Find the probability that the individual gets cancer, given that he does not smoke.

$P(C|NS) = \frac{P(C+NS)}{P(NS)} = \frac{.04}{.75} = .05\bar{3}$

(d) Find the probability that the individual does not get cancer, given that he does not smoke.

$P(NS|NC) = \frac{P(NS+NC)}{P(NC)} = \frac{.71}{.75} = .94\bar{6}$

Here are the counts (in thousands) of earned degrees in the United States in a recent year, classified by level and by the sex of the degree recipient:

	Bachelor's	Master's	Professional	Doctorate	Total
Female	616	194	30	16	856
Male	529	171	44	26	770
Total	1145	365	74	42	1626

7. If you choose a degree recipient at random, what is the probability that the person you choose is a woman?

$\frac{856}{1626} = .526$

8. What is the probability that a randomly chosen degree recipient is a man?

$\frac{770}{1626} = .474$

9. What is the conditional probability that you choose a woman, given that the person chosen received a professional degree?

$P(W|PD)$ $\frac{30}{74} = .405$

10. What is the conditional probability that the person chosen received a bachelor's degree, given that he is a man?

$\frac{529}{770} = .687$

11. Are the events "choose a woman" and "choose a professional degree recipient" *independent*? How do you know?

NO B/c woman have Prof. Degrees

$P(W) = \frac{856}{1626} = .526$

$P(PD) = \frac{74}{1626} = .046$

$P(W PD) = \frac{30}{1626} = .018$ > no

$P(W) \cdot P(PD) = (.526)(.046) = .024$

12. Use the multiplication rule to find the probability of choosing a male bachelor's degree recipient.

$\frac{529}{1626} \Leftarrow \underset{M}{\frac{770}{1626}} \cdot \overset{M\ BD}{\frac{529}{770}}$

13. Confirm your answer to Question 6 by finding the probability of choosing a male bachelor's degree recipient directly from the table of counts above.

Consider the following activity: The letters in the word AARDVARK are printed on square pieces of tagboard (same size squares) with one letter per card. The eight letter cards are then placed in a hat, and one letter card is randomly chosen (without looking) from the hat.

14. List the sample space S of all possible outcomes.

S = {A, R D V K}

15. Make a table that shows the set of outcomes (X) and the probability of each outcome:

Outcomes, X	A	R	D	V	K
P(X)	$\frac{3}{8}$	$\frac{2}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$

16. Consider the following events:

V: the letter chosen is a vowel.
F: the letter chosen falls in the first half of the alphabet (that is, between A and M).

List the outcomes in each of the following events, and determine their probabilities:

V = { A } P(V) = 3/8

F = { A, D, K } P(F) = 5/8 3 + 1 + 1

V or F = {A, D, K } P(V or F) = $\frac{3}{8} + \frac{5}{8} - \frac{3}{8} = 5/8$

F^c = { V, R } P(F^c) = 3/8
1 - 5/8 = 3

17. Determine if the events V and F are independent.

$P(V) = \frac{3}{8}$ $P(F) = 5/8$ $15/64 =$

$P(V \cap F) = 3/8 \neq$ not independent