28.1

What Did The Girl Rock Say To The Boy Rock

Find the answer to any question below in the code key. Notice the letter next to it. Print this letter in the box at the bottom of the page that contains the problem number. Keep working and you will discover the answer to the title question.

CODE KEY	
$\frac{5}{12}$	R
$\frac{1}{2}$	T
30	D
$\frac{1}{4}$	I
50	O
$\frac{2}{5}$	B
15	A
$\frac{1}{3}$	U
$\frac{1}{6}$	E
$\frac{1}{5}$	L

① If a coin is tossed, what is the probability of getting a head?

② If a coin is tossed, what is the probability of getting a tail?

③ Suppose a coin is tossed 100 times. About how many times would you expect to get heads?

Suppose you roll a regular 6-faced die. What is the probability of rolling:

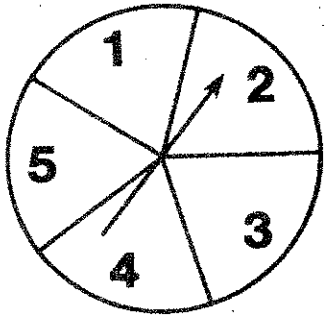
④ a 6? ⑤ a 2? ⑥ a 4?

⑦ Suppose you roll a 6-faced die 90 times. About how many times would you expect to get a 5?

Suppose a jar contains 5 red marbles, 4 white marbles, and 3 blue marbles. If a marble is drawn at random from the jar, what is the probability that it is:

⑧ red? ⑨ white? ⑩ blue?

A spinner is pictured at the right. If the arrow is spun, what is the probability that the spinner lands on:



⑪ 2?

⑫ 3?

⑬ 5?

⑭ an even number?

⑮ a number less than 3?

⑯ Suppose the arrow is spun 50 times. About how many times would you expect the spinner to land on an odd number?

14	5	7	13	10	2	1	11	4	15	3	9	12	16	6	8

Key

What Did The Girl Rock Say To The Boy Rock?

Find the answer to any question below in the code key. Notice the letter next to it. Print this letter in the box at the bottom of the page that contains the problem number. Keep working and you will discover the answer to the title question.

① If a coin is tossed, what is the probability of getting a head? $\frac{1}{2}$

② If a coin is tossed, what is the probability of getting a tail? $\frac{1}{2}$

③ Suppose a coin is tossed 100 times. About how many times would you expect to get heads? 50

Suppose you roll a regular 6-faced die. What is the probability of rolling:

④ a 6? $\frac{1}{6}$ ⑤ a 2? $\frac{1}{6}$ ⑥ a 4? $\frac{1}{6}$

⑦ Suppose you roll a 6-faced die 90 times. About how many times would you expect to get a 5? 15

Suppose a jar contains 5 red marbles, 4 white marbles, and 3 blue marbles. If a marble is drawn at random from the jar, what is the probability that it is:

⑧ red? $\frac{5}{12}$ ⑨ white? $\frac{4}{12} = \frac{1}{3}$ ⑩ blue? $\frac{3}{12} = \frac{1}{4}$

A spinner is pictured at the right. If the arrow is spun, what is the probability that the spinner lands on:

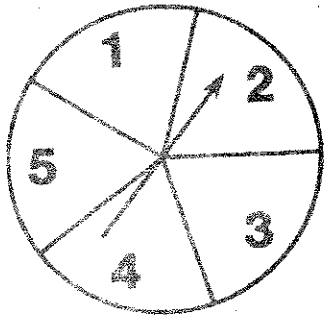
⑪ 2? $\frac{1}{5}$

⑫ 3? $\frac{1}{5}$

⑬ 5? $\frac{1}{5}$

⑭ an even number? $\frac{2}{5}$

⑮ a number less than 3? $\frac{2}{5}$



⑯ Suppose the arrow is spun 50 times. About how many times would you expect the spinner to land on an odd number?

CODE KEY	
$\frac{5}{12}$	R
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$\frac{1}{5}$	L

14	5	7	13	10	2	1	11	4	15	3	9	12	16	6	8
B	E	A	L	T	T	T	L	E	B	O	U	L	D	E	R

Multiplication Principle

By using a tree diagram for each of the compound experiments discussed in the previous section, we can list all the equally probable outcomes and determine the total number of outcomes by counting the number of branches of the tree. The results, summarized in the accompanying table, show that the number of branches in a tree diagram can be calculated easily by using multiplication.

Compound Experiment	Number of Outcomes of First Experiment	Number of Outcomes of Second Experiment	Total Number of Outcomes
Toss of two coins			
Roll of die and toss of coin			
Toss of two dice			

Sometimes it is not necessary to construct a complete tree diagram. Instead, multiplication can be used to calculate the total number of outcomes without listing all of them. This Multiplication Principle can be stated as a general rule. If one thing can be done m ways, and a second thing n ways, then there are $m \times n$ ways of doing both things. Thus, for example, if there are three ways of traveling from City A to City B (auto, train, plane) and two ways of traveling from City B to City C (boat, plane), then there are 3×2 or 6 ways of traveling from City A to City C with a stopover in City B.

On Your Own

Spinner A is divided into six equal sectors, numbered 1, 2, 3, 4, 5, 6. Spinner B is divided into eight equal sectors, numbered 1, 2, 3, 4, 5, 6, 7, 8. In a certain game, spinner A is spun and then spinner B is spun.

a. How many outcomes are possible?

b. Are the outcomes equally likely?

c. What is the probability of spinning a 3 on spinner A and an 8 on spinner B?

1. Suppose Bob, Mary, Tom, Bill, and Alice are nominated for school safety patrol, but only two are to be chosen. The teacher could randomly choose two from this group of five by assigning each student a different number from 1 to 5.

1. Draw a tree diagram to represent the outcomes of this selection process. The first column of branches should indicate the five possibilities for the first selection. The second column of branches should indicate the possibilities for the second selection.

2. How many possible paths are on the tree?

3. Are the possible outcomes equally likely?

4. What is the probability that Mary and Tom are selected (in either order)?

5. What is the probability that two boys are selected?

6. What is the probability that at least one boy is selected?

7. What are the odds against selecting two girls?

8. What are the odds in favor of selecting at least one girl?

2. A certain restaurant offers select-your-own sandwiches. That is, a person may select one item from each of the categories listed:

Bread	Filling	Extras
White Wheat	Tuna Chicken Cheese	Sprouts Lettuce

a. Using a tree diagram, list all possible sandwiches that can be ordered.

b. Would you expect the choices of a sandwich to be equally likely for most customers?

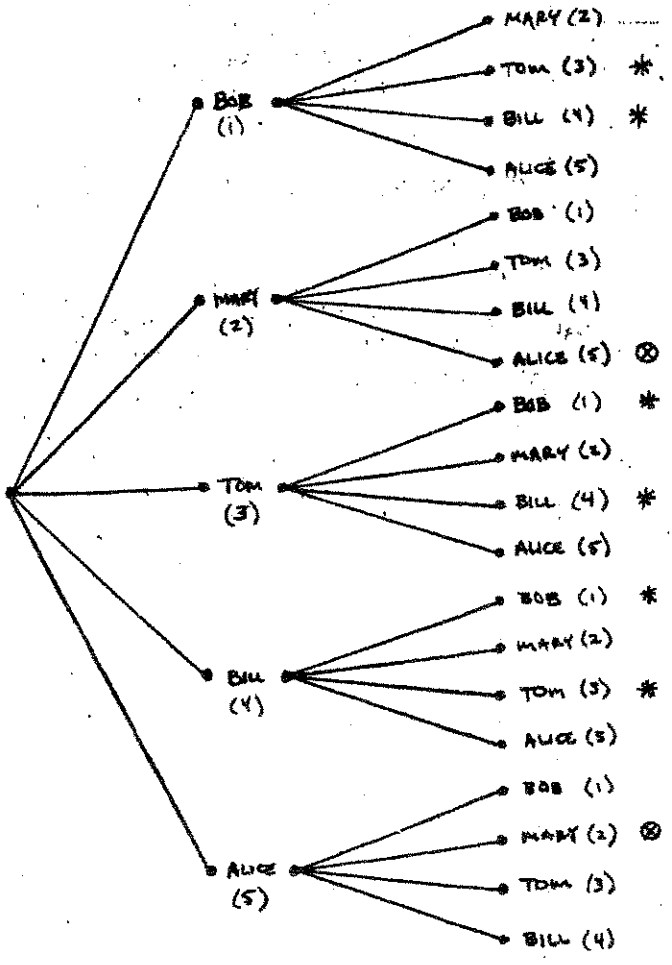
3. A certain General American model car can be ordered with one of three engine sizes, with or without air conditioning, and with automatic or manual transmission.

a. Show, by means of a tree diagram, all the possible ways this model car can be ordered.

b. Suppose you want the car with the smallest engine, air conditioning, and manual transmission. A General American agency tells you there is only one of the cars on hand. What is the probability that it has the features you want, if you assume the outcomes to be equally likely?

1. Suppose Bob (1), Mary (2), Tom (3), Bill (4), and Alice (5) are nominated for school safety patrol, but only two are to be chosen. The teacher could randomly choose two from this group of five by assigning each student a different number from 1 to 5.

1. Draw a tree diagram to represent the outcomes of this selection process. The first column of branches should indicate the five possibilities for the first selection. The second column of branches should indicate the possibilities for the second selection.
2. How many possible paths are on the tree? 20
3. Are the possible outcomes equally likely? YES
4. What is the probability that Mary and Tom are selected (in either order)? $2/20 = 1/10$
5. What is the probability that two boys are selected? * → $6/20 = 3/10$ $(= 3/5 \cdot 3/4)$
6. What is the probability that at least one boy is selected? NOT ⊗'s → $1 - 2/20 = 18/20 = 9/10$
7. What are the "odds" against selecting two girls? $18:2 = 9:1$
8. What are the "odds" in favor of selecting at least one girl? $14:6 = 7:3$

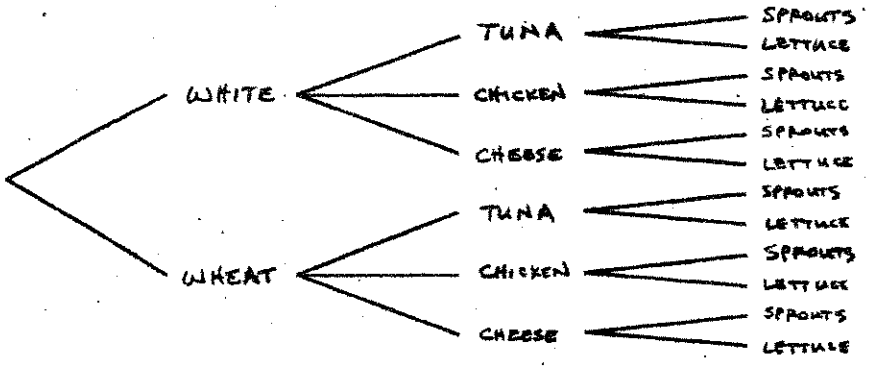


2. A certain restaurant offers select-your-own sandwiches. That is, a person may select one item from each of the categories listed:

Bread	Filling	Extras
White Wheat	Tuna Chicken Cheese	Sprouts Lettuce

a. Using a tree diagram, list all possible sandwiches that can be ordered.

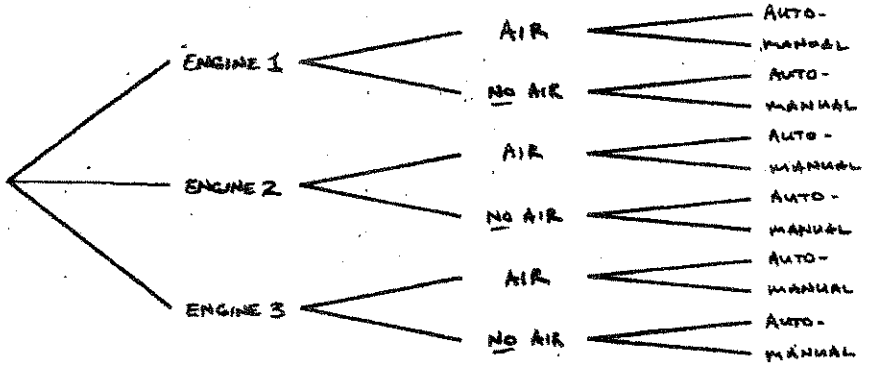
b. Would you expect the choices of a sandwich to be equally likely for most customers? NO!



3. A certain General American model car can be ordered with one of three engine sizes, with or without air conditioning, and with automatic or manual transmission.

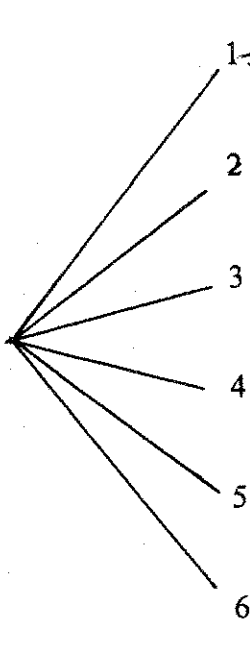
a. Show, by means of a tree diagram, all the possible ways this model car can be ordered.

b. Suppose you want the car with the smallest engine, air conditioning, and manual transmission. A General American agency tells you there is only one of the cars on hand. What is the probability that it has the features you want, if you assume the outcomes to be equally likely? 1/12



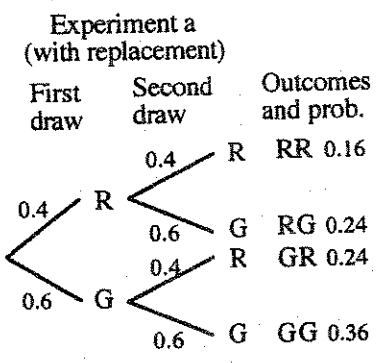
HOMEWORK 28.1: 2, 3, 6, 7, 8 ,9, 10

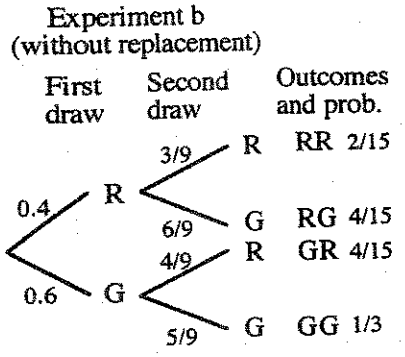
2.



DIE	COIN	SAMPLE SPACE	PROBABILITY
1	H	1H	1/12
	T	1T	1/12
2	H	2H	1/12
	T	2T	1/12
3	H	3H	1/12
	T	3T	1/12
4	H	4H	1/12
	T	4T	1/12
5	H	5H	1/12
	T	5T	1/12
6	H	6H	1/12
	T	6T	1/12

3. The condensed tree diagram might look like these:



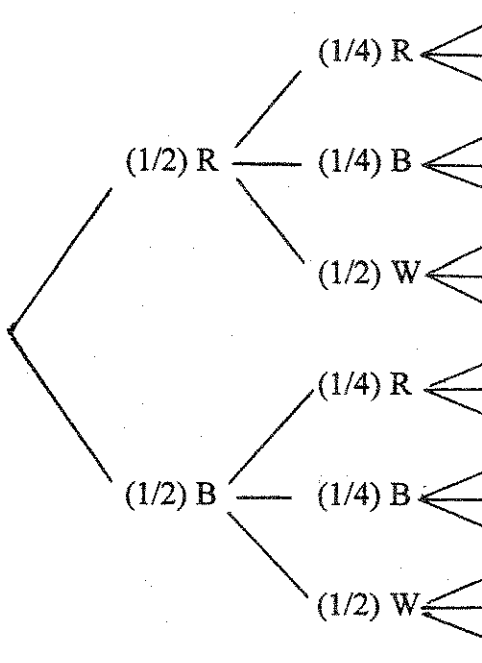


6. The outcomes are as follows:

HHHH	HHHT	HHTH	HHTT
HTHH	HTHT	HTTH	HTTT
THHH	THHT	THTH	THTT
TTHH	TTHT	TTTH	TTTT

So there are 16 equally likely outcomes in the sample space, each with a probability of 1/16.

7.



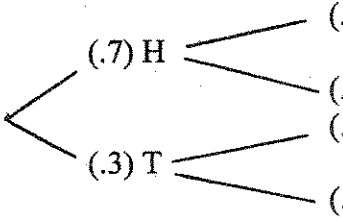
Spinner1	spinner2	Spinner 3	Sample space	Probability
		(1/3) R	RRR	1/24
	(1/4) R	(1/3) B	RRB	1/24
		(1/3) W	RRW	1/24
		(1/3) R	RBR	1/24
(1/2) R	(1/4) B	(1/3) B	RBB	1/24
		(1/3) W	RBW	1/24
		(1/3) R	RWR	1/12
	(1/2) W	(1/3) B	RWB	1/12
		(1/3) W	RWW	1/12
		(1/3) R	BRR	1/24
	(1/4) R	(1/3) B	BRB	1/24
		(1/3) W	BRW	1/24
		(1/3) R	BBR	1/24
(1/2) B	(1/4) B	(1/3) B	BBB	1/24
		(1/3) W	BBW	1/24
		(1/3) R	BWR	1/12
	(1/2) W	(1/3) B	BWB	1/12
		(1/3) W	BWW	1/12
				24/24 = 1

b. P(at least one R) = 1 – P(no red) = 1 – 6/24 = 18/24 = ¾
c. P(at least one B) = P(at least one R) = 18/24 = ¾ because ???

8. The sample space is:
HH1, HH2, HH3, HH4, HH5, HH6, HT1, HT2, HT3, **HT4, HT5, HT6,**
TH1, TH2, TH3, **TH4, TH5, TH6,** T1, TT2, TT3, TT4, TT5, TT6

Each outcome is equally likely and has a probability of 1/24
P(one H, one T and number greater than 3) = 6/24

9. For the unfair coin, set up the same as for a fair coin toss, but the probabilities are different.



First toss	2nd toss	outcomes	probabilities	fair coin
	(.7) H	HH	0.49	.25
(.7) H	(.3) T	HT	.21	.25
	(.7) H	TH	.21	.25
(.3) T	(.3) T	TT	.09	.25

10. ALL of these outcomes are **equally likely** to occur. They each have the probability of $\frac{1}{2^{10}} = \frac{1}{1024}$. Note that while each of these ordered outcomes is equally likely, unordered or grouped outcomes like getting 5 heads and 5 tails (in some combination) is more likely to occur than getting all 10 heads.