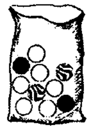
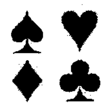
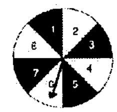
Notes -- Intro to Probability & The Counting Principle





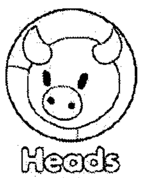


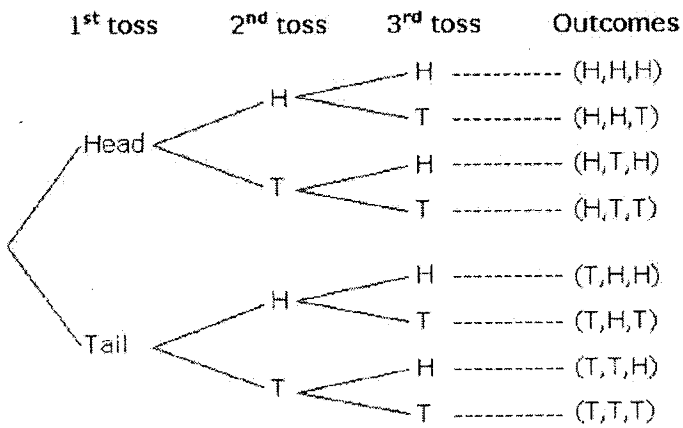
Basic Probability

Things to Know . . .

Tossing a 2-sided Coin

If you have multiple tosses, a tree diagram may help . . .





Selecting a Card from a Standard Deck

Standard Deck of 52 Playing Cards:

Diamonds (Red):	2♦	3♦	4♦	5♦	6♦	7♦	8♦	9♦	10♦	J♦	Q♦	K♦	A♦
Hearts (Red):	2♥	3♥	4♥	5♥	6♥	7♥	8♥	9♥	10♥	J♥	Q♥	K♥	A♥
Clubs (Black):	2♣	3♣	4♣	5♣	6♣	7♣	8♣	9♣	10♣	J♣	Q♣	K♣	A♣
Spades (Black):	2♠	3♠	4♠	5♠	6♠	7♠	8♠	9♠	10♠	J♠	Q♠	K♠	A♠

There are
52 cards in a standard deck
with jokers removed.

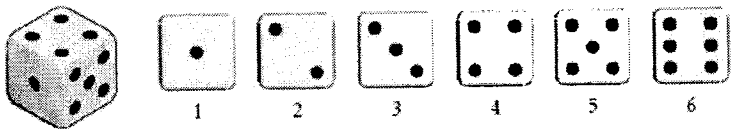
There are 4 suits:
Spades, Clubs, Hearts, Diamonds

There are 26 black cards, and 26 red cards.

Each suit has 13 cards,
each of a different rank.

Face cards are Jacks, Queens, and Kings.
There are 12 face cards
in a deck.

Rolling a Standard Die



	1	2	3	4	5	6
1	1,1 2	1,2 3	1,3 4	1,4 5	1,5 6	1,6 7
2	2,1 3	2,2 4	2,3 5	2,4 6	2,5 7	2,6 8
3	3,1 4	3,2 5	3,3 6	3,4 7	3,5 8	3,6 9
4	4,1 5	4,2 6	4,3 7	4,4 8	4,5 9	4,6 10
5	5,1 6	5,2 7	5,3 8	5,4 9	5,5 10	5,6 11
6	6,1 7	6,2 8	6,3 9	6,4 10	6,5 11	6,6 12

Basic Probability

probability of an event = $\dfrac{\text{the \# of outcomes which make up the event}}{\text{the total \# of outcomes}}$

Example 1 Roll a die. Find:

A. p(even #) $\frac{3}{6} = \frac{1}{2}$

B. p(5) $\frac{1}{6}$

C. p(zero) $\frac{0}{6} = 0$

D. p(not 3) $\frac{5}{6}$

$1 - p(3) = 1 - \frac{1}{6} = \frac{5}{6}$

Example 2 Toss a coin. Find:

A. p(head) $\frac{1}{2}$

B. p(tails) $\frac{1}{2}$

Example 3 Draw a card. Find:

A. p(heart) $\frac{13}{52} = \frac{1}{4}$

B. p(black) $\frac{26}{52} = \frac{1}{2}$

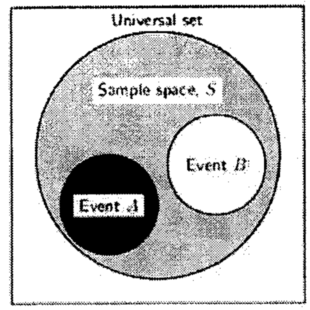
C. p(not diamond) $\frac{39}{52} = \frac{3}{4}$ $\quad 1 - p(\text{diamond}) = 1 - \frac{13}{52} = \frac{3}{4}$

D. p(red queen) $\frac{2}{52} = \frac{1}{26}$

E. p(face card) $\frac{12}{52} = \frac{3}{13}$

The Fundamental Counting Principle

If task A can be completed in "a" ways, and task B can be completed in "b" ways, then task A followed by task B can be completed in a · b ways.



outcome --the result of a single trial

Sample Space --the set of all possible outcomes

Example 4 How many ways can a president and a secretary be chosen for a 4-member club? Assume the same person can't be both. Suppose the club members are Andy, Bill, Cathy, and Dawn.

P	S
A	B
A	C
A	D
B	A
B	C
B	D

P	S
C	A
C	B
C	D
D	A
D	B
D	C

12 outcomes

$4 \cdot 3 = 12$

Example 5 How many outcomes are possible?

a. You flip a coin. 2

b. You flip a coin and roll a 6-sided die. $2 \cdot 6 = 12$

c. You flip a coin, roll a die, and pick a card from a standard deck.

$2 \cdot 6 \cdot 52 = 624$

Example 6 At dinner you must choose an appetizer, an entrée, and a dessert. Your choices are:

appetizer—salad, fruit, or cheese

entrée—chicken or steak

dessert—pie or cake

How many outcomes are possible?

$3 \cdot 2 \cdot 2 = 12$

Example 7 A license plate is composed of 2 letters followed by 3 numbers followed by 2 letters. How many outcomes are possible?

$$\underline{26} \cdot \underline{26} \cdot \underline{10} \cdot \underline{10} \cdot \underline{10} \cdot \underline{26} \cdot \underline{26} = 456{,}976{,}000$$

Example 8 A license plate is composed of 2 letters followed by 3 numbers followed by 2 letters. You cannot repeat letters or numbers. How many outcomes are possible?

$$\underline{26} \cdot \underline{25} \cdot \underline{10} \cdot \underline{9} \cdot \underline{8} \cdot \underline{24} \cdot \underline{23} = 258{,}336{,}000$$

Example 9 A combination is composed of 3 digits. If you can repeat digits, how many combinations are possible?

$$10 \cdot 10 \cdot 10 = 1000$$

Example 10 A combination is composed of 3 digits. If you cannot repeat digits, how many combinations are possible?

$$10 \cdot 9 \cdot 8 = 720$$