Counting the Outcomes of Experiments

Jonathan R. Bacolod

Sauyo High School

How to Count the Outcomes of an Experiment?

How to Count the Outcomes of an Experiment?

1. Table

How to Count the Outcomes of an Experiment?

1. Table
2. Tree Diagram

How to Count the Outcomes of an Experiment?

1. Table
2. Tree Diagram
3. Systematic Listing

How to Count the Outcomes of an Experiment?

1. Table
2. Tree Diagram
3. Systematic Listing
4. Fundamental Counting Principle (FCP)

Example 1

On a Saturday morning, you washed most of your clothes and they are still wet. Your friend invites you to attend his birthday party and you are left with only 2 pants and 3 shirts. In how many different ways can you dress?

Example 1: Using a Table

Example 1: Using a Table

Pants = 2 ways to choose

Example 1: Using a Table

Pants = 2 ways to choose
Shirts = 3 ways to choose

Example 1: Using a Table

Pants = 2 ways to choose
Shirts = 3 ways to choose
$n(S) = ?$

Example 1: Using a Table

Pants = 2 ways to choose
Shirts = 3 ways to choose
n(S) = ?

	Pant 1	**Pant 2**

Example 1: Using a Table

Pants = 2 ways to choose
Shirts = 3 ways to choose
n(S) = ?

	Pant 1	**Pant 2**
Shirt 1	$S_1 P_1$	$S_1 P_2$

Example 1: Using a Table

Pants = 2 ways to choose
Shirts = 3 ways to choose
n(S) = ?

	Pant 1	**Pant 2**
Shirt 1	$S_1 P_1$	$S_1 P_2$
Shirt 2	$S_2 P_1$	$S_2 P_2$

Example 1: Using a Table

Pants = 2 ways to choose
Shirts = 3 ways to choose
n(S) = ?

	Pant 1	**Pant 2**
Shirt 1	$S_1 P_1$	$S_1 P_2$
Shirt 2	$S_2 P_1$	$S_2 P_2$
Shirt 3	$S_3 P_1$	$S_3 P_2$

Example 1: Using a Table

Pants = 2 ways to choose
Shirts = 3 ways to choose
n(S) = ?

	Pant 1	**Pant 2**
Shirt 1	$S_1 P_1$	$S_1 P_2$
Shirt 2	$S_2 P_1$	$S_2 P_2$
Shirt 3	$S_3 P_1$	$S_3 P_2$

$$\therefore n(S) = 6$$

Example 1: Using a Tree Diagram

Pants = 2 ways to choose
Shirts = 3 ways to choose
$n(S) = ?$

Example 1: Using a Tree Diagram

Pants = 2 ways to choose
Shirts = 3 ways to choose
n(S) = ?

P_1

Example 1: Using a Tree Diagram

Pants = 2 ways to choose
Shirts = 3 ways to choose
n(S) = ?

$$P_1 \longrightarrow S_1$$

Example 1: Using a Tree Diagram

Pants = 2 ways to choose
Shirts = 3 ways to choose
n(S) = ?

$$P_1 \longrightarrow S_1 \quad \text{———} \quad P_1 S_1$$

Example 1: Using a Tree Diagram

Pants = 2 ways to choose
Shirts = 3 ways to choose
n(S) = ?

$$\begin{tikzcd} & S_1 \arrow[r, dash] & P_1S_1 \\ P_1 \arrow[ur] \arrow[r] & S_2 & \end{tikzcd}$$

Example 1: Using a Tree Diagram

Pants = 2 ways to choose
Shirts = 3 ways to choose
n(S) = ?

$$\begin{tikzcd} & S_1 \arrow[r, dash] & P_1 S_1 \\ P_1 \arrow[ur] \arrow[r] & S_2 \arrow[r, dash] & P_1 S_2 \end{tikzcd}$$

Example 1: Using a Tree Diagram

Pants = 2 ways to choose
Shirts = 3 ways to choose
n(S) = ?

$$\begin{tikzcd}
 & S_1 \arrow[r, dash] & P_1 S_1 \\
P_1 \arrow[ur] \arrow[r] \arrow[dr] & S_2 \arrow[r, dash] & P_1 S_2 \\
 & S_3 &
\end{tikzcd}$$

Example 1: Using a Tree Diagram

Pants = 2 ways to choose
Shirts = 3 ways to choose
n(S) = ?

$$\begin{array}{ccccc} & \nearrow & S_1 & \text{———} & P_1 S_1 \\ P_1 & \longrightarrow & S_2 & \text{———} & P_1 S_2 \\ & \searrow & S_3 & \text{———} & P_1 S_3 \end{array}$$

Example 1: Using a Tree Diagram

Pants = 2 ways to choose
Shirts = 3 ways to choose
n(S) = ?

$$
\begin{tikzcd}
 & S_1 \arrow[r, dash] & P_1S_1 \\
P_1 \arrow[ur] \arrow[r] \arrow[dr] & S_2 \arrow[r, dash] & P_1S_2 \\
 & S_3 \arrow[r, dash] & P_1S_3 \\
 & & \\
P_2 & &
\end{tikzcd}
$$

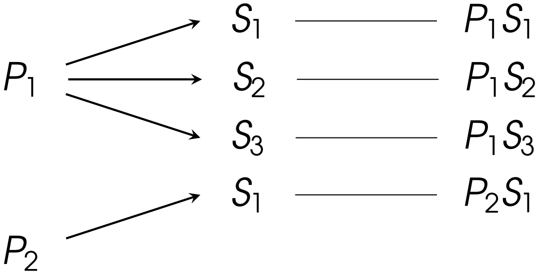
Example 1: Using a Tree Diagram

Pants = 2 ways to choose
Shirts = 3 ways to choose
n(S) = ?

$$
\begin{tikzcd}
 & S_1 \arrow[r, dash] & P_1S_1 \\
P_1 \arrow[ur] \arrow[r] \arrow[dr] & S_2 \arrow[r, dash] & P_1S_2 \\
 & S_3 \arrow[r, dash] & P_1S_3 \\
 & S_1 & \\
P_2 \arrow[ur] & &
\end{tikzcd}
$$

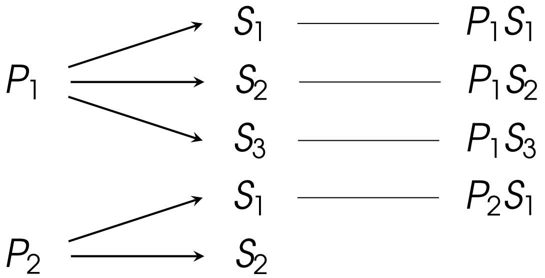
Example 1: Using a Tree Diagram

Pants = 2 ways to choose
Shirts = 3 ways to choose
n(S) = ?



Example 1: Using a Tree Diagram

Pants = 2 ways to choose
Shirts = 3 ways to choose
n(S) = ?



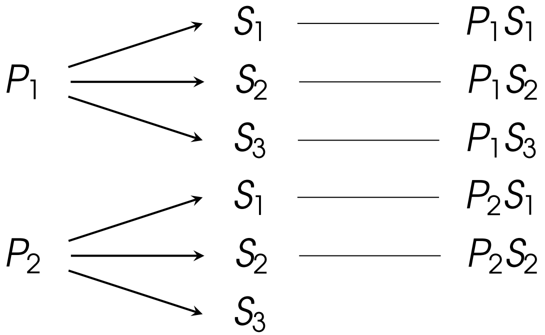
Example 1: Using a Tree Diagram

Pants = 2 ways to choose
Shirts = 3 ways to choose
n(S) = ?

$$
\begin{tikzcd}
 & S_1 \arrow[r, dash] & P_1S_1 \\
P_1 \arrow[ur] \arrow[r] \arrow[dr] & S_2 \arrow[r, dash] & P_1S_2 \\
 & S_3 \arrow[r, dash] & P_1S_3 \\
 & S_1 \arrow[r, dash] & P_2S_1 \\
P_2 \arrow[ur] \arrow[r] & S_2 \arrow[r, dash] & P_2S_2
\end{tikzcd}
$$

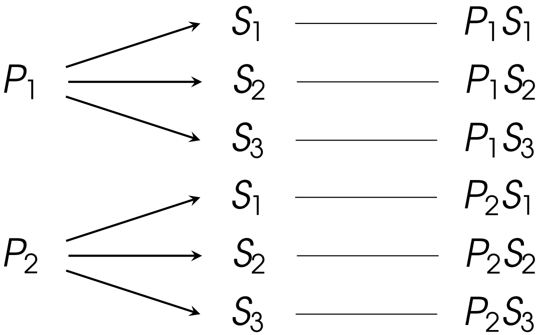
Example 1: Using a Tree Diagram

Pants = 2 ways to choose
Shirts = 3 ways to choose
n(S) = ?



Example 1: Using a Tree Diagram

Pants = 2 ways to choose
Shirts = 3 ways to choose
n(S) = ?



Example 1: Using a Tree Diagram

Pants = 2 ways to choose
Shirts = 3 ways to choose
n(S) = ?

$$\begin{array}{ccccc}
 & \nearrow & S_1 & \text{———} & P_1S_1 \\
P_1 & \rightarrow & S_2 & \text{———} & P_1S_2 \\
 & \searrow & S_3 & \text{———} & P_1S_3 \\
 & \nearrow & S_1 & \text{———} & P_2S_1 \\
P_2 & \rightarrow & S_2 & \text{———} & P_2S_2 \\
 & \searrow & S_3 & \text{———} & P_2S_3
\end{array}$$

$$\therefore n(S) = 6$$

Example 1: Using Systematic Listing

Pants = 2 ways to choose
Shirts = 3 ways to choose
$n(S) = ?$

Example 1: Using Systematic Listing

Pants = 2 ways to choose
Shirts = 3 ways to choose
n(S) = ?

Pant 1 and Shirt 1

Example 1: Using Systematic Listing

Pants = 2 ways to choose
Shirts = 3 ways to choose
n(S) = ?

Pant 1 and Shirt 1
Pant 1 and Shirt 2

Example 1: Using Systematic Listing

Pants = 2 ways to choose
Shirts = 3 ways to choose
n(S) = ?

Pant 1 and Shirt 1
Pant 1 and Shirt 2
Pant 1 and Shirt 3

Example 1: Using Systematic Listing

Pants = 2 ways to choose
Shirts = 3 ways to choose
n(S) = ?

Pant 1 and Shirt 1
Pant 1 and Shirt 2
Pant 1 and Shirt 3
Pant 2 and Shirt 1

Example 1: Using Systematic Listing

Pants = 2 ways to choose
Shirts = 3 ways to choose
$n(S) = ?$

Pant 1 and Shirt 1
Pant 1 and Shirt 2
Pant 1 and Shirt 3
Pant 2 and Shirt 1
Pant 2 and Shirt 2

Example 1: Using Systematic Listing

Pants = 2 ways to choose
Shirts = 3 ways to choose
n(S) = ?

Pant 1 and Shirt 1
Pant 1 and Shirt 2
Pant 1 and Shirt 3
Pant 2 and Shirt 1
Pant 2 and Shirt 2
Pant 2 and Shirt 3

Example 1: Using Systematic Listing

Pants = 2 ways to choose
Shirts = 3 ways to choose
n(S) = ?

Pant 1 and Shirt 1
Pant 1 and Shirt 2
Pant 1 and Shirt 3
Pant 2 and Shirt 1
Pant 2 and Shirt 2
Pant 2 and Shirt 3

$$\therefore n(S) = 6$$

What is the Fundamental Counting Principle?

What is the Fundamental Counting Principle?

- We can find the total number of ways different events can occur by multiplying the number of ways each event can happen.

What is the Fundamental Counting Principle?

- We can find the total number of ways different events can occur by multiplying the number of ways each event can happen.
- If one event can occur in m ways, and a second event can occur in n ways, and a third event can occur in p ways, and so on, then the sequence of events can occur in $m \times n \times p \times \ldots$ ways.

Example 1: Using the Fundamental Counting Principle

Pants = 2 ways to choose
Shirts = 3 ways to choose
$n(S) = ?$

Example 1: Using the Fundamental Counting Principle

Pants = 2 ways to choose
Shirts = 3 ways to choose
n(S) = ?

$$n(S) = 2 \times 3$$

Example 1: Using the Fundamental Counting Principle

Pants = 2 ways to choose
Shirts = 3 ways to choose
n(S) = ?

$$n(S) = 2 \times 3$$
$$n(S) = 6$$

Example 1: Using the Fundamental Counting Principle

Pants = 2 ways to choose
Shirts = 3 ways to choose
n(S) = ?

$$n(S) = 2 \times 3$$
$$n(S) = 6$$
$$\therefore \text{ there are 6 different ways can you dress}$$

Example 2

Three 5-peso coins are tossed. How many outcomes are possible?

Example 2: Using a Table

Example 2: Using a Table

First coin = 2 outcomes

Example 2: Using a Table

First coin = 2 outcomes
Second coin = 2 outcomes

Example 2: Using a Table

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes

Example 2: Using a Table

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
$n(S) = ?$

Example 2: Using a Table

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
$n(S) = ?$

Coin 1	**Coin 2**	**Coin 3**	**Outcome**

Example 2: Using a Table

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
n(S) = ?

Coin 1	**Coin 2**	**Coin 3**	**Outcome**
H	H	H	HHH

Example 2: Using a Table

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
n(S) = ?

Coin 1	Coin 2	Coin 3	Outcome
H	H	H	HHH
H	H	T	HHT

Example 2: Using a Table

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
n(S) = ?

Coin 1	**Coin 2**	**Coin 3**	**Outcome**
H	H	H	HHH
H	H	T	HHT
H	T	H	HTH

Example 2: Using a Table

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
n(S) = ?

Coin 1	**Coin 2**	**Coin 3**	**Outcome**
H	H	H	HHH
H	H	T	HHT
H	T	H	HTH
H	T	T	HTT

Example 2: Using a Table

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
n(S) = ?

Coin 1	**Coin 2**	**Coin 3**	**Outcome**
H	H	H	HHH
H	H	T	HHT
H	T	H	HTH
H	T	T	HTT
T	H	H	THH

Example 2: Using a Table

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
n(S) = ?

Coin 1	Coin 2	Coin 3	Outcome
H	H	H	HHH
H	H	T	HHT
H	T	H	HTH
H	T	T	HTT
T	H	H	THH
T	H	T	THT

Example 2: Using a Table

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
n(S) = ?

Coin 1	**Coin 2**	**Coin 3**	**Outcome**
H	H	H	HHH
H	H	T	HHT
H	T	H	HTH
H	T	T	HTT
T	H	H	THH
T	H	T	THT
T	T	H	TTH

Example 2: Using a Table

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
n(S) = ?

Coin 1	**Coin 2**	**Coin 3**	**Outcome**
H	H	H	HHH
H	H	T	HHT
H	T	H	HTH
H	T	T	HTT
T	H	H	THH
T	H	T	THT
T	T	H	TTH
T	T	T	TTT

Example 2: Using a Table

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
n(S) = ?

Coin 1	**Coin 2**	**Coin 3**	**Outcome**
H	H	H	HHH
H	H	T	HHT
H	T	H	HTH
H	T	T	HTT
T	H	H	THH
T	H	T	THT
T	T	H	TTH
T	T	T	TTT

$$\therefore n(S) = 8$$

Example 2: Using a Tree Diagram

Example 2: Using a Tree Diagram

First coin = 2 outcomes

Example 2: Using a Tree Diagram

First coin = 2 outcomes
Second coin = 2 outcomes

Example 2: Using a Tree Diagram

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes

Example 2: Using a Tree Diagram

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
$n(S) = ?$

Example 2: Using a Tree Diagram

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
n(S) = ?

1st Coin	2nd Coin	3rd Coin	Outcome

Example 2: Using a Tree Diagram

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
n(S) = ?

1st Coin	2nd Coin	3rd Coin	Outcome
H			

Example 2: Using a Tree Diagram

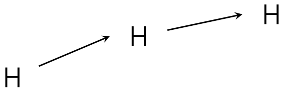
First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
n(S) = ?

1st Coin	**2nd Coin**	**3rd Coin**	**Outcome**
H	H		

Example 2: Using a Tree Diagram

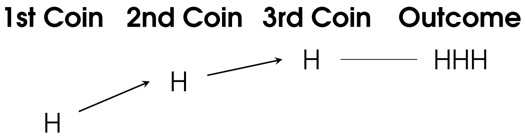
First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
n(S) = ?

1st Coin **2nd Coin** **3rd Coin** **Outcome**



Example 2: Using a Tree Diagram

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
n(S) = ?



Example 2: Using a Tree Diagram

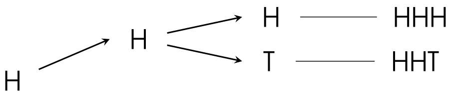
First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
n(S) = ?

1st Coin	**2nd Coin**	**3rd Coin**	**Outcome**
		H	HHH
	H		
		T	
H			

Example 2: Using a Tree Diagram

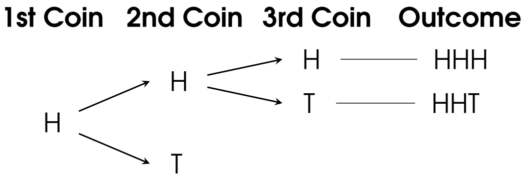
First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
n(S) = ?

1st Coin **2nd Coin** **3rd Coin** **Outcome**



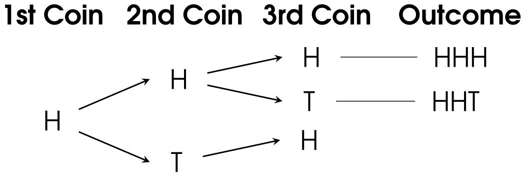
Example 2: Using a Tree Diagram

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
n(S) = ?



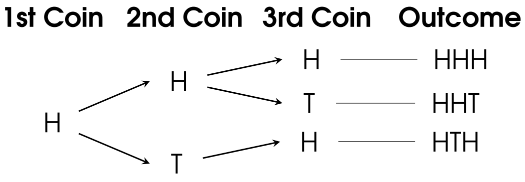
Example 2: Using a Tree Diagram

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
n(S) = ?



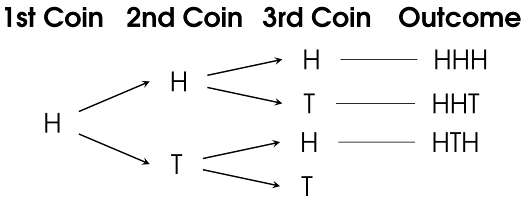
Example 2: Using a Tree Diagram

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
$n(S) = ?$



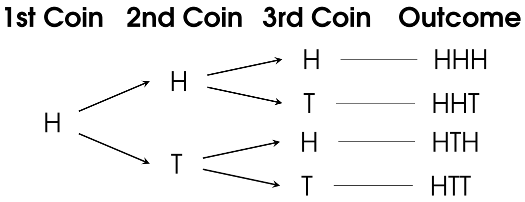
Example 2: Using a Tree Diagram

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
n(S) = ?



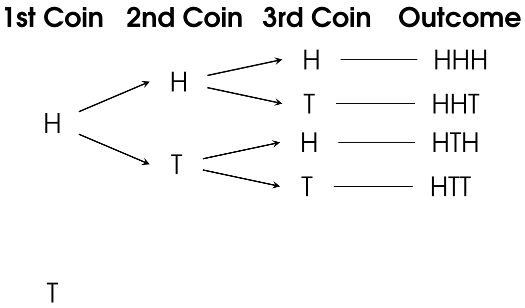
Example 2: Using a Tree Diagram

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
$n(S) = ?$



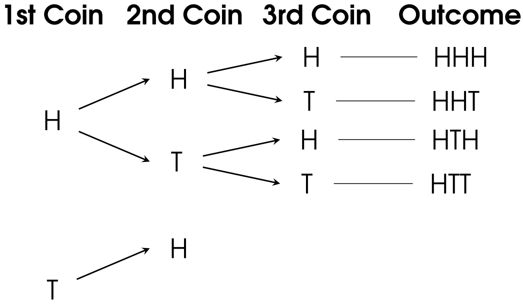
Example 2: Using a Tree Diagram

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
n(S) = ?



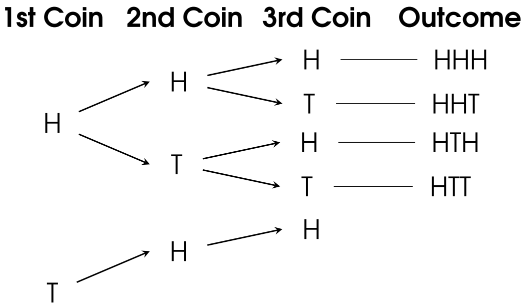
Example 2: Using a Tree Diagram

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
n(S) = ?



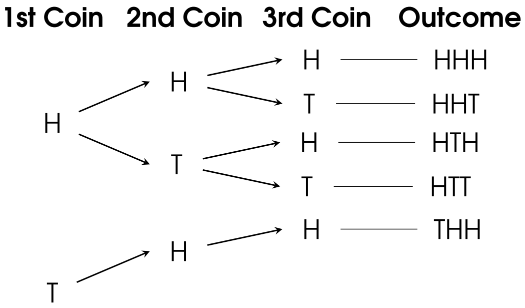
Example 2: Using a Tree Diagram

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
n(S) = ?



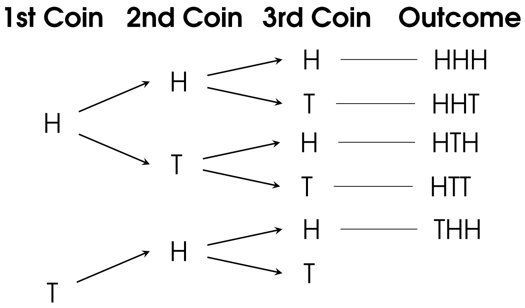
Example 2: Using a Tree Diagram

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
n(S) = ?



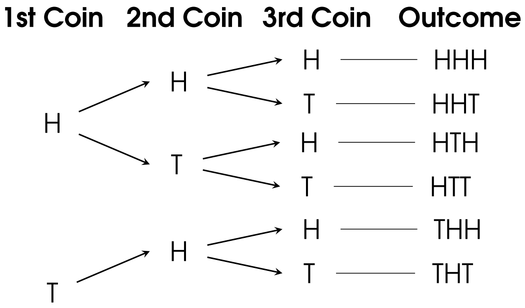
Example 2: Using a Tree Diagram

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
n(S) = ?



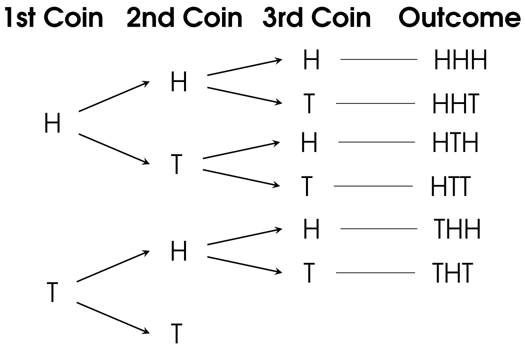
Example 2: Using a Tree Diagram

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
n(S) = ?



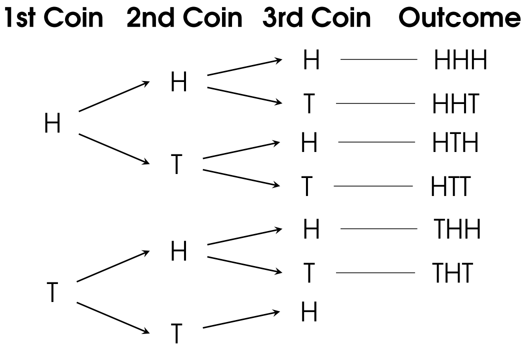
Example 2: Using a Tree Diagram

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
n(S) = ?



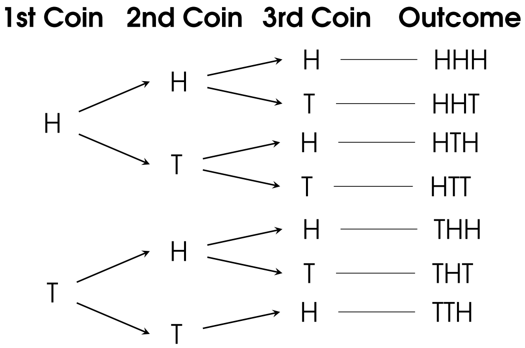
Example 2: Using a Tree Diagram

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
n(S) = ?



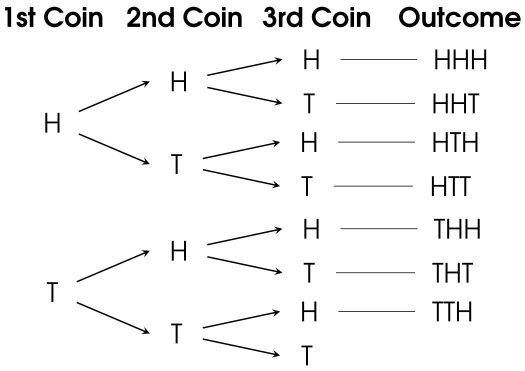
Example 2: Using a Tree Diagram

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
n(S) = ?



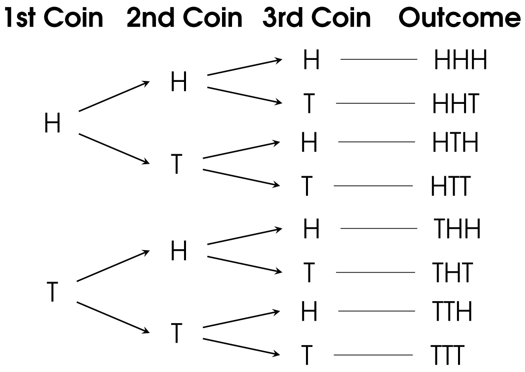
Example 2: Using a Tree Diagram

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
n(S) = ?



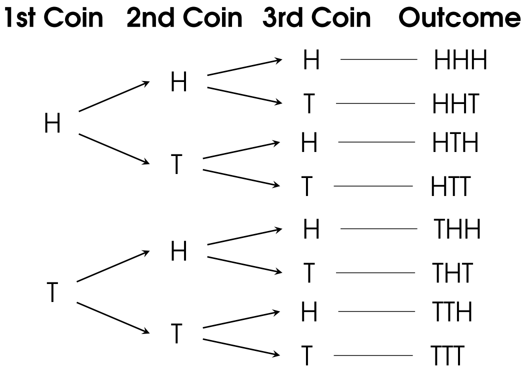
Example 2: Using a Tree Diagram

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
$n(S) = ?$



Example 2: Using a Tree Diagram

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
n(S) = ?



$$\therefore n(S) = 8$$

Example 2: Using Systematic Listing

Example 2: Using Systematic Listing

First coin = 2 outcomes

Example 2: Using Systematic Listing

First coin = 2 outcomes
Second coin = 2 outcomes

Example 2: Using Systematic Listing

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes

Example 2: Using Systematic Listing

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
$n(S) = ?$

Example 2: Using Systematic Listing

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
$n(S) = ?$

HHH

Example 2: Using Systematic Listing

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
$n(S) = ?$

HHH
HHT

Example 2: Using Systematic Listing

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
$n(S) = ?$

HHH
HHT
HTH

Example 2: Using Systematic Listing

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
n(S) = ?

HHH
HHT
HTH
HTT

Example 2: Using Systematic Listing

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
n(S) = ?

HHH	THH
HHT	
HTH	
HTT	

Example 2: Using Systematic Listing

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
n(S) = ?

HHH	THH
HHT	THT
HTH	
HTT	

Example 2: Using Systematic Listing

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
$n(S) = ?$

HHH	THH
HHT	THT
HTH	TTH
HTT	

Example 2: Using Systematic Listing

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
n(S) = ?

HHH	THH
HHT	THT
HTH	TTH
HTT	TTT

Example 2: Using Systematic Listing

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
n(S) = ?

HHH	THH
HHT	THT
HTH	TTH
HTT	TTT

$$\therefore n(S) = 8$$

Example 2: Using the Fundamental Counting Principle

Example 2: Using the Fundamental Counting Principle

First coin = 2 outcomes

Example 2: Using the Fundamental Counting Principle

First coin = 2 outcomes
Second coin = 2 outcomes

Example 2: Using the Fundamental Counting Principle

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes

Example 2: Using the Fundamental Counting Principle

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
$n(S)$ = ?

Example 2: Using the Fundamental Counting Principle

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
n(S) = ?

$$n(S) = 2 \times 2 \times 2$$

Example 2: Using the Fundamental Counting Principle

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
n(S) = ?

$$n(S) = 2 \times 2 \times 2$$
$$n(S) = 8$$

Example 2: Using the Fundamental Counting Principle

First coin = 2 outcomes
Second coin = 2 outcomes
Third coin = 2 outcomes
n(S) = ?

$$n(S) = 2 \times 2 \times 2$$
$$n(S) = 8$$
$$\therefore \text{ there are 8 outcomes possible}$$

Example 3

You go to a restaurant to buy some breakfast. The menu says, for food: pancakes, waffles, or french fries; and for drinks: coffee, juice, hot chocolate, and tea. How many different meal choices do you have?

Example 3: Using a Table

Example 3: Using a Table

Food = 3 ways to choose

Example 3: Using a Table

Food = 3 ways to choose
Drink = 4 ways to choose

Example 3: Using a Table

Food = 3 ways to choose
Drink = 4 ways to choose
$n(S) = ?$

Example 3: Using a Table

Food = 3 ways to choose
Drink = 4 ways to choose
n(S) = ?

	Coffee (C)	**Juice (J)**	**Hot Choco (H)**	**Tea (T)**

Example 3: Using a Table

Food = 3 ways to choose
Drink = 4 ways to choose
n(S) = ?

	Coffee (C)	**Juice (J)**	**Hot Choco (H)**	**Tea (T)**
Pancake (P)	PC	PJ	PH	PT

Example 3: Using a Table

Food = 3 ways to choose
Drink = 4 ways to choose
n(S) = ?

	Coffee (C)	**Juice (J)**	**Hot Choco (H)**	**Tea (T)**
Pancake (P)	PC	PJ	PH	PT
Waffles (W)	WC	WJ	WH	WT

Example 3: Using a Table

Food = 3 ways to choose
Drink = 4 ways to choose
n(S) = ?

	Coffee (C)	**Juice (J)**	**Hot Choco (H)**	**Tea (T)**
Pancake (P)	PC	PJ	PH	PT
Waffles (W)	WC	WJ	WH	WT
Fries (F)	FC	FJ	FH	FT

Example 3: Using a Table

Food = 3 ways to choose
Drink = 4 ways to choose
n(S) = ?

	Coffee (C)	**Juice (J)**	**Hot Choco (H)**	**Tea (T)**
Pancake (P)	PC	PJ	PH	PT
Waffles (W)	WC	WJ	WH	WT
Fries (F)	FC	FJ	FH	FT

$$\therefore n(S) = 12$$

Example 3: Using a Tree Diagram

Example 3: Using a Tree Diagram

Food = 3 ways to choose

Example 3: Using a Tree Diagram

Food = 3 ways to choose
Drink = 4 ways to choose

Example 3: Using a Tree Diagram

Food = 3 ways to choose
Drink = 4 ways to choose
$n(S) = ?$

Example 3: Using a Tree Diagram

Food = 3 ways to choose
Drink = 4 ways to choose
n(S) = ?

P

Example 3: Using a Tree Diagram

Food = 3 ways to choose
Drink = 4 ways to choose
n(S) = ?

$$P \longrightarrow C$$

Example 3: Using a Tree Diagram

Food = 3 ways to choose
Drink = 4 ways to choose
n(S) = ?

$$P \longrightarrow C \;\text{———}\; PC$$

Example 3: Using a Tree Diagram

Food = 3 ways to choose
Drink = 4 ways to choose
n(S) = ?

$$\begin{tikzcd} & C \arrow[r, dash] & PC \\ P \arrow[ur] \arrow[r] & J & \end{tikzcd}$$

Example 3: Using a Tree Diagram

Food = 3 ways to choose
Drink = 4 ways to choose
n(S) = ?

$$\begin{tikzcd} & C \arrow[r, dash] & PC \\ P \arrow[ur] \arrow[r] & J \arrow[r, dash] & PJ \end{tikzcd}$$

Example 3: Using a Tree Diagram

Food = 3 ways to choose
Drink = 4 ways to choose
n(S) = ?

$$
\begin{tikzcd}
 & C \arrow[r, dash] & PC \\
P \arrow[ur] \arrow[r] \arrow[dr] & J \arrow[r, dash] & PJ \\
 & H &
\end{tikzcd}
$$

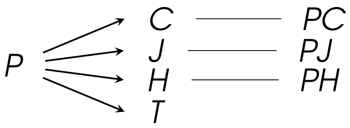
Example 3: Using a Tree Diagram

Food = 3 ways to choose
Drink = 4 ways to choose
n(S) = ?

$$
\begin{tikzcd}
 & C \arrow[r, dash] & PC \\
P \arrow[ur] \arrow[r] \arrow[dr] & J \arrow[r, dash] & PJ \\
 & H \arrow[r, dash] & PH
\end{tikzcd}
$$

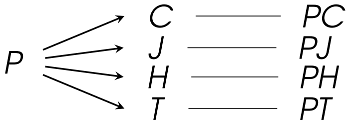
Example 3: Using a Tree Diagram

Food = 3 ways to choose
Drink = 4 ways to choose
n(S) = ?



Example 3: Using a Tree Diagram

Food = 3 ways to choose
Drink = 4 ways to choose
n(S) = ?



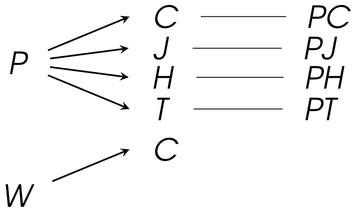
Example 3: Using a Tree Diagram

Food = 3 ways to choose
Drink = 4 ways to choose
n(S) = ?

$$
\begin{array}{ccccc}
 & & C & \text{———} & PC \\
 & \nearrow & J & \text{———} & PJ \\
P & \rightrightarrows & H & \text{———} & PH \\
 & \searrow & T & \text{———} & PT \\
 & & & & \\
W & & & &
\end{array}
$$

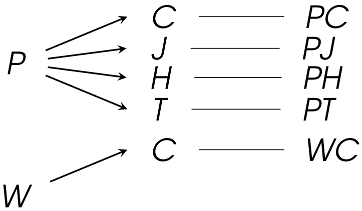
Example 3: Using a Tree Diagram

Food = 3 ways to choose
Drink = 4 ways to choose
n(S) = ?



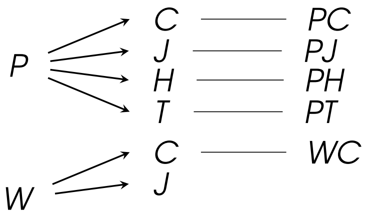
Example 3: Using a Tree Diagram

Food = 3 ways to choose
Drink = 4 ways to choose
n(S) = ?



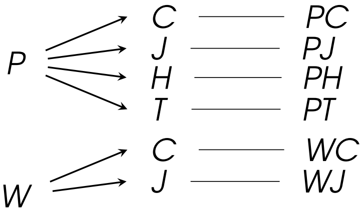
Example 3: Using a Tree Diagram

Food = 3 ways to choose
Drink = 4 ways to choose
n(S) = ?



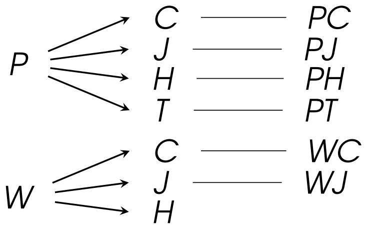
Example 3: Using a Tree Diagram

Food = 3 ways to choose
Drink = 4 ways to choose
n(S) = ?



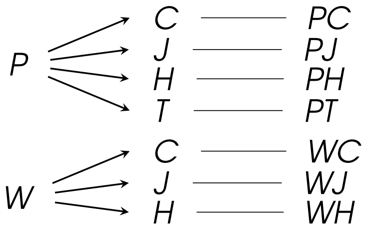
Example 3: Using a Tree Diagram

Food = 3 ways to choose
Drink = 4 ways to choose
n(S) = ?



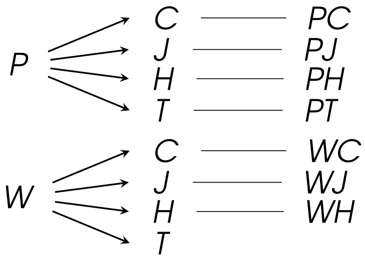
Example 3: Using a Tree Diagram

Food = 3 ways to choose
Drink = 4 ways to choose
n(S) = ?



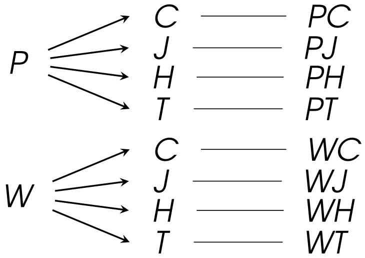
Example 3: Using a Tree Diagram

Food = 3 ways to choose
Drink = 4 ways to choose
n(S) = ?



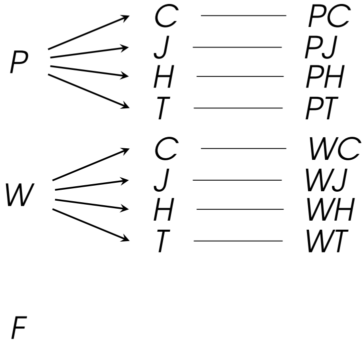
Example 3: Using a Tree Diagram

Food = 3 ways to choose
Drink = 4 ways to choose
n(S) = ?



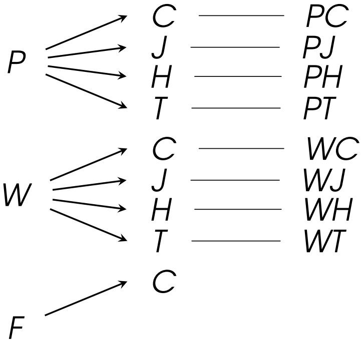
Example 3: Using a Tree Diagram

Food = 3 ways to choose
Drink = 4 ways to choose
n(S) = ?



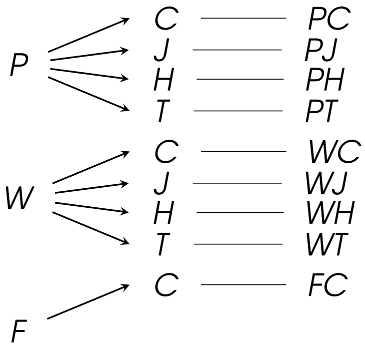
Example 3: Using a Tree Diagram

Food = 3 ways to choose
Drink = 4 ways to choose
n(S) = ?



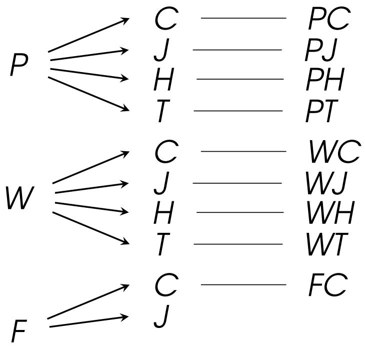
Example 3: Using a Tree Diagram

Food = 3 ways to choose
Drink = 4 ways to choose
n(S) = ?



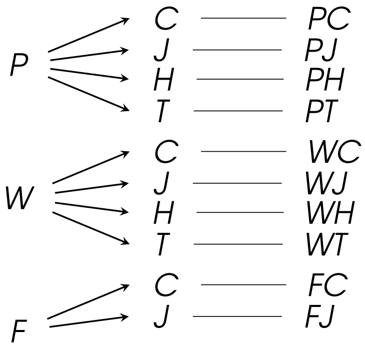
Example 3: Using a Tree Diagram

Food = 3 ways to choose
Drink = 4 ways to choose
n(S) = ?



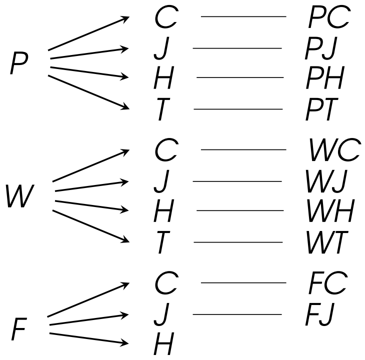
Example 3: Using a Tree Diagram

Food = 3 ways to choose
Drink = 4 ways to choose
n(S) = ?



Example 3: Using a Tree Diagram

Food = 3 ways to choose
Drink = 4 ways to choose
n(S) = ?



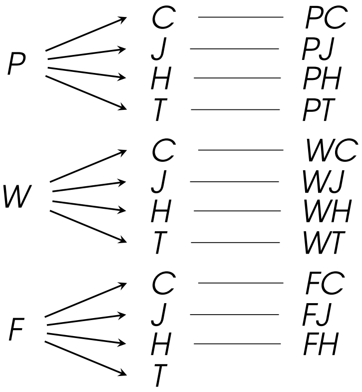
Example 3: Using a Tree Diagram

Food = 3 ways to choose
Drink = 4 ways to choose
n(S) = ?

P	*C*	*PC*
	J	*PJ*
	H	*PH*
	T	*PT*
W	*C*	*WC*
	J	*WJ*
	H	*WH*
	T	*WT*
F	*C*	*FC*
	J	*FJ*
	H	*FH*

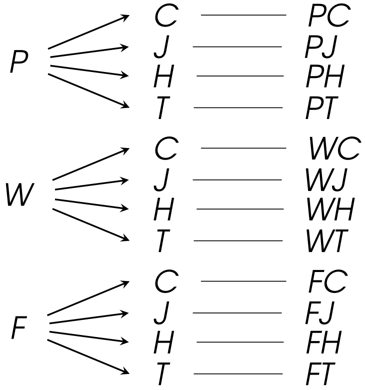
Example 3: Using a Tree Diagram

Food = 3 ways to choose
Drink = 4 ways to choose
n(S) = ?



Example 3: Using a Tree Diagram

Food = 3 ways to choose
Drink = 4 ways to choose
n(S) = ?



Example 3: Using a Tree Diagram

Food = 3 ways to choose
Drink = 4 ways to choose
n(S) = ?

P	C	PC
	J	PJ
	H	PH
	T	PT
W	C	WC
	J	WJ
	H	WH
	T	WT
F	C	FC
	J	FJ
	H	FH
	T	FT

$$\therefore n(S) = 12$$

Example 3: Using Systematic Listing

Example 3: Using Systematic Listing

Food = 3 ways to choose

Example 3: Using Systematic Listing

Food = 3 ways to choose
Drink = 4 ways to choose

Example 3: Using Systematic Listing

Food = 3 ways to choose
Drink = 4 ways to choose
$n(S) = ?$

Example 3: Using Systematic Listing

Food = 3 ways to choose
Drink = 4 ways to choose
n(S) = ?

PC

Example 3: Using Systematic Listing

Food = 3 ways to choose
Drink = 4 ways to choose
n(S) = ?

PC
PJ

Example 3: Using Systematic Listing

Food = 3 ways to choose
Drink = 4 ways to choose
n(S) = ?

PC
PJ
PH

Example 3: Using Systematic Listing

Food = 3 ways to choose
Drink = 4 ways to choose
n(S) = ?

PC
PJ
PH
PT

Example 3: Using Systematic Listing

Food = 3 ways to choose
Drink = 4 ways to choose
n(S) = ?

PC	WC
PJ	
PH	
PT	

Example 3: Using Systematic Listing

Food = 3 ways to choose
Drink = 4 ways to choose
n(S) = ?

PC	WC
PJ	WJ
PH	
PT	

Example 3: Using Systematic Listing

Food = 3 ways to choose
Drink = 4 ways to choose
n(S) = ?

PC	WC
PJ	WJ
PH	WH
PT	

Example 3: Using Systematic Listing

Food = 3 ways to choose
Drink = 4 ways to choose
n(S) = ?

PC	WC
PJ	WJ
PH	WH
PT	WT

Example 3: Using Systematic Listing

Food = 3 ways to choose
Drink = 4 ways to choose
n(S) = ?

PC	WC	FC
PJ	WJ	
PH	WH	
PT	WT	

Example 3: Using Systematic Listing

Food = 3 ways to choose
Drink = 4 ways to choose
n(S) = ?

PC	WC	FC
PJ	WJ	FJ
PH	WH	
PT	WT	

Example 3: Using Systematic Listing

Food = 3 ways to choose
Drink = 4 ways to choose
n(S) = ?

PC	WC	FC
PJ	WJ	FJ
PH	WH	FH
PT	WT	

Example 3: Using Systematic Listing

Food = 3 ways to choose
Drink = 4 ways to choose
n(S) = ?

PC	WC	FC
PJ	WJ	FJ
PH	WH	FH
PT	WT	FT

Example 3: Using Systematic Listing

Food = 3 ways to choose
Drink = 4 ways to choose
n(S) = ?

PC	WC	FC
PJ	WJ	FJ
PH	WH	FH
PT	WT	FT

$$\therefore n(S) = 12$$

Example 3: Using the Fundamental Counting Principle

Example 3: Using the Fundamental Counting Principle

Food = 3 ways to choose

Example 3: Using the Fundamental Counting Principle

Food = 3 ways to choose
Drink = 4 ways to choose

Example 3: Using the Fundamental Counting Principle

Food = 3 ways to choose
Drink = 4 ways to choose
$n(S) = ?$

Example 3: Using the Fundamental Counting Principle

Food = 3 ways to choose
Drink = 4 ways to choose
n(S) = ?

$$n(S) = 3 \times 4$$

Example 3: Using the Fundamental Counting Principle

Food = 3 ways to choose
Drink = 4 ways to choose
n(S) = ?

$$n(S) = 3 \times 4$$
$$n(S) = 12$$

Example 3: Using the Fundamental Counting Principle

Food = 3 ways to choose
Drink = 4 ways to choose
n(S) = ?

$$n(S) = 3 \times 4$$
$$n(S) = 12$$
$$\therefore \text{there are 12 different meal choices}$$

Example 4

Find the number of possible outcomes for each scenario using the fundamental counting principle.

1. Boys and girls in a family with two children.

Example 4

Find the number of possible outcomes for each scenario using the fundamental counting principle.

1. Boys and girls in a family with two children.

$n(S) = 2 \times 2$

Example 4

Find the number of possible outcomes for each scenario using the fundamental counting principle.

1. Boys and girls in a family with two children.

$n(S) = 2 \times 2$
$n(S) = 4$ possible outcomes

Example 4

Find the number of possible outcomes for each scenario using the fundamental counting principle.

2. Choosing a 3G or 4G cellphone that comes in black, white, or transparent.

Example 4

Find the number of possible outcomes for each scenario using the fundamental counting principle.

2. Choosing a 3G or 4G cellphone that comes in black, white, or transparent.

$n(S) = 2 \times 3$

Example 4

Find the number of possible outcomes for each scenario using the fundamental counting principle.

2. Choosing a 3G or 4G cellphone that comes in black, white, or transparent.

$n(S) = 2 \times 3$
$n(S) = 6$ possible outcomes

Example 4

Find the number of possible outcomes for each scenario using the fundamental counting principle.

3. A choice of Spanish, muffin or toast bread with coffee, milk, or juice.

Example 4

Find the number of possible outcomes for each scenario using the fundamental counting principle.

3. A choice of Spanish, muffin or toast bread with coffee, milk, or juice.

$n(S) = 3 \times 3$

Example 4

Find the number of possible outcomes for each scenario using the fundamental counting principle.

3. A choice of Spanish, muffin or toast bread with coffee, milk, or juice.

$n(S) = 3 \times 3$
$n(S) = 9$ possible outcomes

Example 4

Find the number of possible outcomes for each scenario using the fundamental counting principle.

4. Elias has a choice of a queen or king with a choice of hearts, diamonds, clubs, or spades.

Example 4

Find the number of possible outcomes for each scenario using the fundamental counting principle.

4. Elias has a choice of a queen or king with a choice of hearts, diamonds, clubs, or spades.

$n(S) = 2 \times 4$

Example 4

Find the number of possible outcomes for each scenario using the fundamental counting principle.

4. Elias has a choice of a queen or king with a choice of hearts, diamonds, clubs, or spades.

$n(S) = 2 \times 4$
$n(S) = 8$ possible outcomes

Example 4

Find the number of possible outcomes for each scenario using the fundamental counting principle.

5. A die is rolled and a coin is tossed.

Example 4

Find the number of possible outcomes for each scenario using the fundamental counting principle.

5. A die is rolled and a coin is tossed.

$n(S) = 6 \times 2$

Example 4

Find the number of possible outcomes for each scenario using the fundamental counting principle.

5. A die is rolled and a coin is tossed.

$n(S) = 6 \times 2$
$n(S) = 12$ possible outcomes

Example 5

Solve each problem completely.

1. In how many ways can 1 out of 4 blue flags, 1 out of 3 red flags, and 1 out of 2 green flags be arranged on a pole?

Example 5

Solve each problem completely.

1. In how many ways can 1 out of 4 blue flags, 1 out of 3 red flags, and 1 out of 2 green flags be arranged on a pole?

$n(S) = 4 \times 3 \times 2$

Example 5

Solve each problem completely.

1. In how many ways can 1 out of 4 blue flags, 1 out of 3 red flags, and 1 out of 2 green flags be arranged on a pole?

$n(S) = 4 \times 3 \times 2$
$n(S) = 24$ ways

Example 5

Solve each problem completely.

2. A lock contains 3 dials, each with ten digits. How many possible sequences of numbers exist?

Example 5

Solve each problem completely.

2. A lock contains 3 dials, each with ten digits. How many possible sequences of numbers exist?

$n(S) = 10 \times 10 \times 10$

Example 5

Solve each problem completely.

2. A lock contains 3 dials, each with ten digits. How many possible sequences of numbers exist?

$n(S) = 10 \times 10 \times 10$
$n(S) = 1,000$ possible sequences of numbers

Example 5

Solve each problem completely.

3. Four students are to be chosen from a group of 9 to fill the positions of president, vice-president, treasurer and secretary. In how many ways can this be accomplished?

Example 5

Solve each problem completely.

3. Four students are to be chosen from a group of 9 to fill the positions of president, vice-president, treasurer and secretary. In how many ways can this be accomplished?

$n(S) = 9 \times 8 \times 7 \times 6$

Example 5

Solve each problem completely.

3. Four students are to be chosen from a group of 9 to fill the positions of president, vice-president, treasurer and secretary. In how many ways can this be accomplished?

$n(S) = 9 \times 8 \times 7 \times 6$
$n(S) = 3,024$ ways

Example 5

Solve each problem completely.

4. How many 5-number license plates can be made using the digits 0, 1, 2, 3, 4, 5, if repetitions are allowed?

Example 5

Solve each problem completely.

4. How many 5-number license plates can be made using the digits 0, 1, 2, 3, 4, 5, if repetitions are allowed?

$n(S) = 6 \times 6 \times 6 \times 6 \times 6$

Example 5

Solve each problem completely.

4. How many 5-number license plates can be made using the digits 0, 1, 2, 3, 4, 5, if repetitions are allowed?

$n(S) = 6 \times 6 \times 6 \times 6 \times 6$
$n(S) = 7,776$ license plates

Example 5

Solve each problem completely.

5. How many 5-number license plates can be made using the digits 0, 1, 2, 3, 4, 5, if repetitions are not allowed?

Example 5

Solve each problem completely.

5. How many 5-number license plates can be made using the digits 0, 1, 2, 3, 4, 5, if repetitions are not allowed?

$n(S) = 6 \times 5 \times 4 \times 3 \times 2$

Example 5

Solve each problem completely.

5. How many 5-number license plates can be made using the digits 0, 1, 2, 3, 4, 5, if repetitions are not allowed?

$n(S) = 6 \times 5 \times 4 \times 3 \times 2$
$n(S) = 720$ license plates

Thank you for attending the virtual class.