

Probability experiment

- Toss two coins
- Toss three coins
- Roll two dice



Activity 1: An Experiment with 2 coins

WE TOSS TWO COINS



When we toss two coins at the same time,
the “possible outcomes” are:

(two Heads) or (one head and one Tail) or
(one Tail and one Head) or (two Tails);

in short : **HH HT TH TT** respectively;

where **H** is denoted for Head and **T** is denoted for Tail.

Therefore:

the number of the possible outcomes are:

$$2*2 = 2^2 = 4$$

We toss two coins*



*this experiment involves two parts,
'the first toss of the coin' and
'the second toss of the coin':*

*experiments that have two parts
can be represented in two ways*

✧ **Tree diagramm**

✧ **Tabular form**

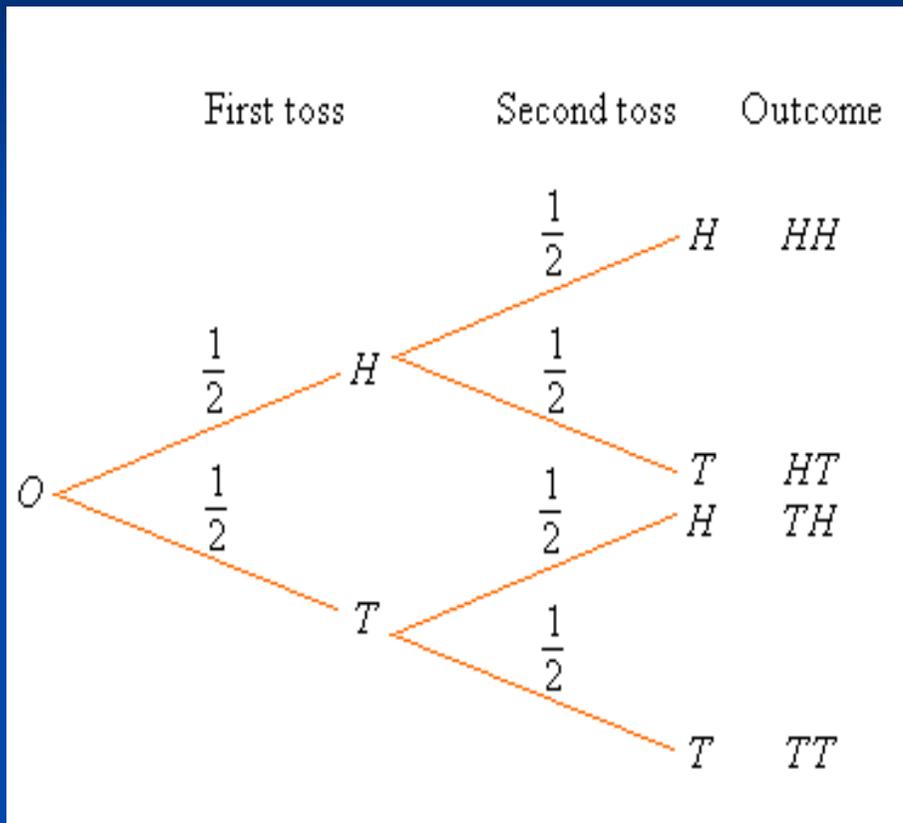


**It notes that:*

*“tossing two different coins “ or
“tossing the same coin two times”
is the same experiment!*

We toss two coins

TREE DIAGRAM



TABULAR FORM

the following table uses rows to represent 'the first toss of the coin' and columns to represent 'the second toss of the coin'.

		Second toss	
		H	T
First toss	H	HH	HT
	T	TH	TT

the sample space is given by $S = \{ HH, HT, TH, TT \}$

Two different coins are tossed randomly.
Find the probability of getting:

- two Heads
- 1 Head and 1 Tail (*HT* or *TH*)
- only one Head

Now... be careful !

- **never** Head (not Head) *
- **at least once** Head

* *It notes that:*

*the event "at least once Head" and the event "never Head"
are Complementary events*

Two different coins are tossed randomly.
Find the probability of getting:

- $P(HH) = \frac{1}{4}$
- $P(HT \text{ or } TH) = \frac{2}{4}$
- $P(\text{only one H}) = \frac{2}{4}$
- $P(\text{Never Head}) = \frac{1}{4}$ ← *Complementary Events !*
- $P(\text{AT LEAST once Head}) = \frac{3}{4}$ ←

Remember this important rule:

$$P(\text{at least once } E) = 1 - P(\text{Never } E)$$

Almeno una volta E

MAI E

Activity 2: An Experiment with 3 coins

TRY IT YOURSELF

Three different coins are tossed randomly.
Find the probability of getting:

- Three Heads
- 1 Head and 2 Tails
- only one Tail
- **Not** Head (never Head)
- **at least once** Head

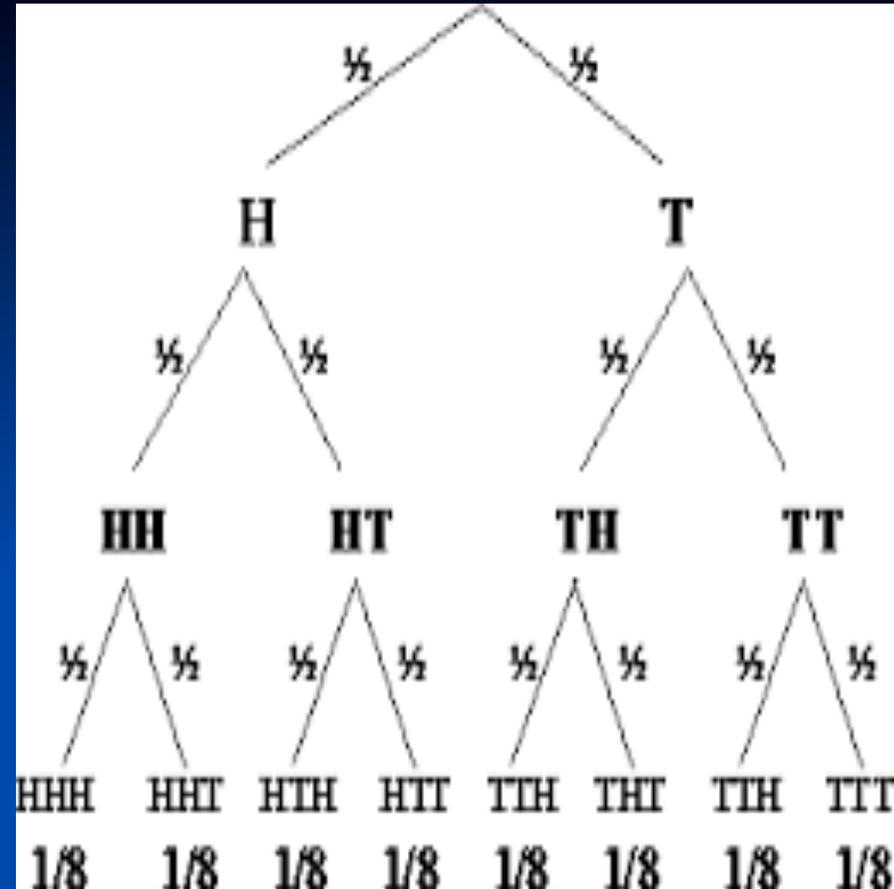


counsel to represent the situation with a tree diagram !

Answers

Three different coins are tossed randomly

- $P(\text{HHH}) = 1/8$
- $P(\text{1 Head and 2 Tails}) = P(\text{HTT, THT, TTH}) = 3/8$
- $P(\text{only one Tail}) = P(\text{THH, HTH, HHT}) = 3/8$
- $P(\text{not Head}) = P(\text{TTT}) = 1/8$
- $P(\text{at least once Head}) = 1 - P(\text{not H}) = 1 - 1/8 = 7/8$



Activity 3: An Experiment with 2 dice *

Let's roll two dice and add the scores



How can I represent
the problem:
“rolling two dice”?

**Interesting point: the plural is dice, but the singular is die: 1 die, 2 dice.*

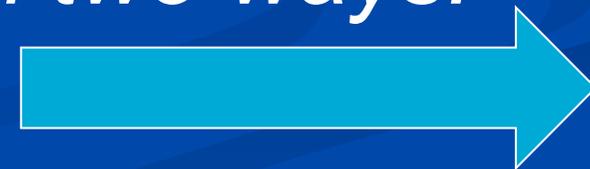
You roll two dice and add the scores

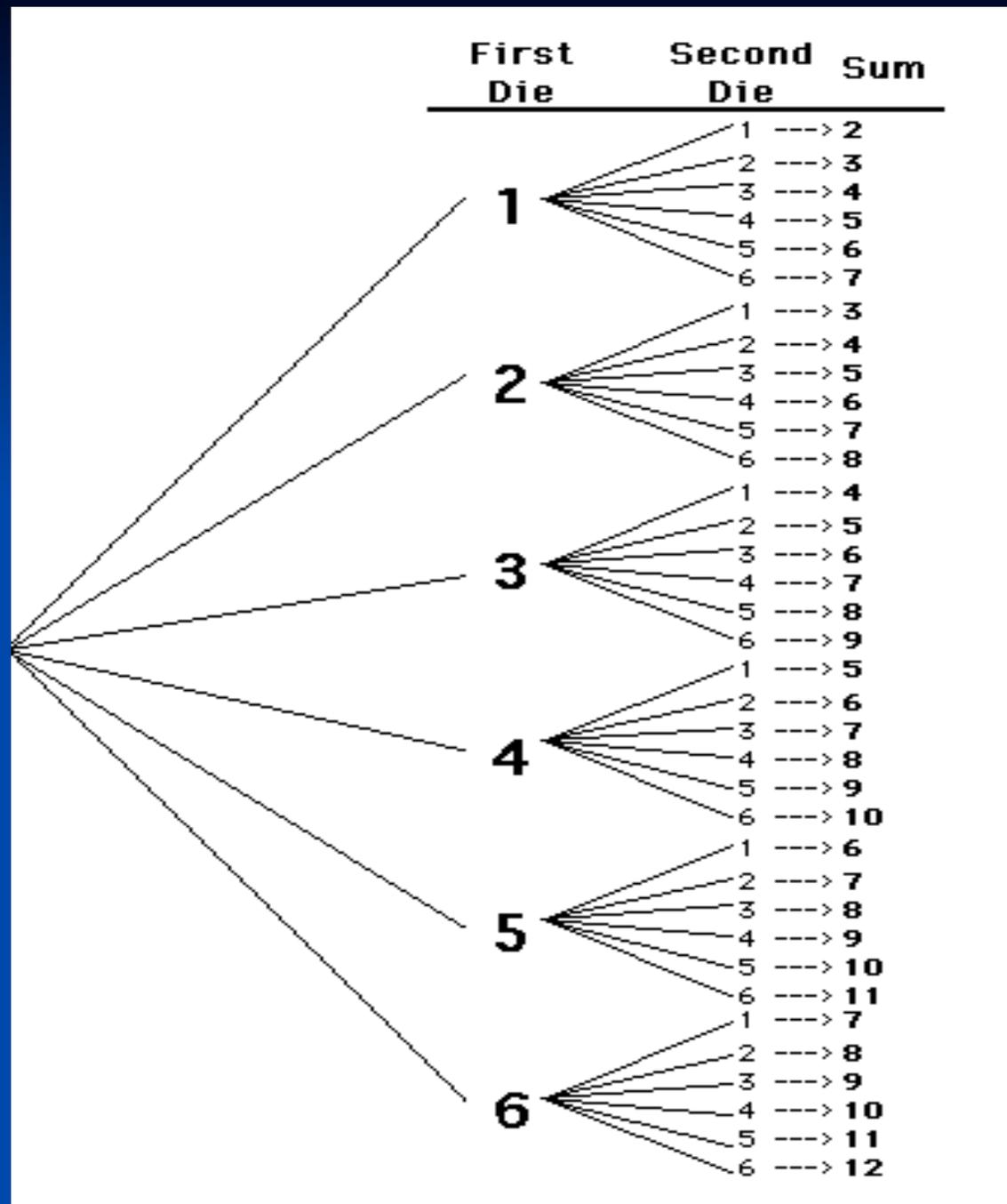


When rolling two dice*,
distinguish between them in some way:
a first one and second one,
a left and a right, a red and a green, etc.

*Experiments that have two parts
can be represented in two ways:*

- ✧ *with tree diagram*
- ✧ *or in tabular form*





**ROLLING
TWO DICE:
TREE DIAGRAM
and
DICE SUM
situation**

ROLLING TWO DICE : TABULAR FORM



the following table uses rows to represent 'the scores of the first die' and columns to represent 'the scores of the second die'

		Score on One Die					
		1	2	3	4	5	6
Score on the Other Die	1	2	3	4	5	6	7
	2	3	4	5	6	7	8
	3	4	5	6	7	8	9
	4	5	6	7	8	9	10
	5	6	7	8	9	10	11
	6	7	8	9	10	11	12

Sample space diagram for total scores of two dice

you roll two dice and add the scores ...

		Score on One Die					
		1	2	3	4	5	6
Score on the Other Die	1	2	3	4	5	6	7
	2	3	4	5	6	7	8
	3	4	5	6	7	8	9
	4	5	6	7	8	9	10
	5	6	7	8	9	10	11
	6	7	8	9	10	11	12

You can see: there is only 1 way to get 2,
there are 2 ways to get 3,
there are 3 ways to get 4, and so on....

Can you see the Symmetry in this table?

2 and 12 have the same number of ways = 1 each
3 and 11 have the same number of ways = 2 each
4 and 10 have the same number of ways = 3 each
5 and 9 have the same number of ways = 4 each
6 and 8 have the same number of ways = 5 each

Questions

TRY IT YOURSELF



you roll two dice and add the scores

If you roll 2 dice together and add the two scores:

- 1. What is **the least** possible total score?
- 2. What is **the greatest** possible total score?
- 3. What do you think is **the most likely** total score?

you roll two dice and add the scores ...

Answers

The least

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

Most likely

The greatest

The first two questions are quite easy to answer:

- 1. **The least** possible total score must be $1 + 1 = 2$
- 2. **The greatest** possible total score must be $6 + 6 = 12$
- 3. What is the **most likely** total score?

7 has the highest bar, so **7** is the most likely total score.

Questions

TRY IT YOURSELF

You roll two dice and add the scores :

- 1. Which is Probability of a total score of 4 ?**
- 2. Which is Probability of a total score of 6 ?**
- 3. Which is Probability of a total score of 7 ?**

Answers

You roll two dice and add the scores ...

1) Which is Probability of a total score of 4 ?

We know there are 36 possible outcomes.

And there is only 3 way to get a total score of 4.

So the probability of getting 4 is:

Probability (of a 4) = $P(4) = 3/36$

2) $P(\text{of a } 6) = 5/36$

3) $P(\text{of a } 7) = 6/36$

Esercises :

TRY IT YOURSELF

Calculating the probabilities of each score

Rolling a Die and tossing a Coin

If you *roll a die* and **toss a coin**:

- a) which is the number of the possible outcomes?
- b) represent the situation with the **tree diagram** and then with the **tabular form**

What is the probability of obtaining:

- c) *five* **and** a Head
- d) *five* **or** Head
- e) *an even number* **and** Tail