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DeepLearning.AI

Math for Machine Learning

Probability and Statistics - Week 1

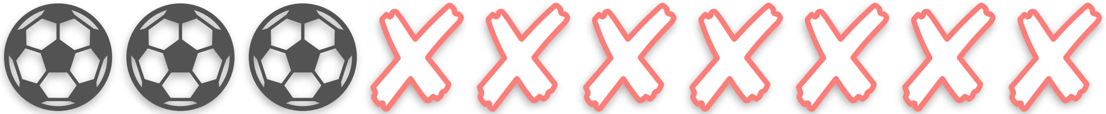
DeepLearning.AI

Introduction to probability

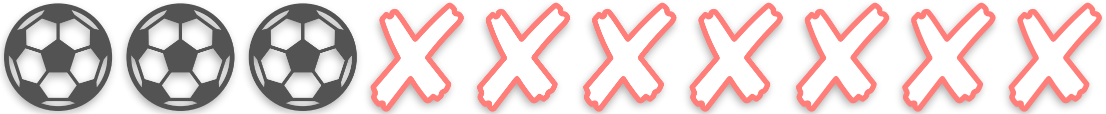
What is Probability?

Introduction to Probability

Introduction to Probability

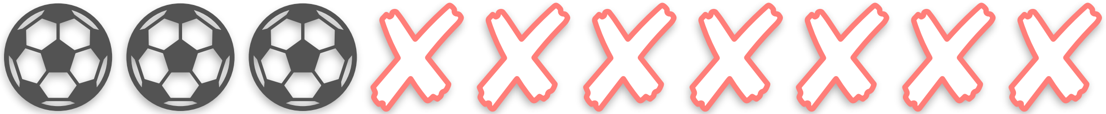


Introduction to Probability



Find the probability that a child picked at random plays soccer.

Introduction to Probability



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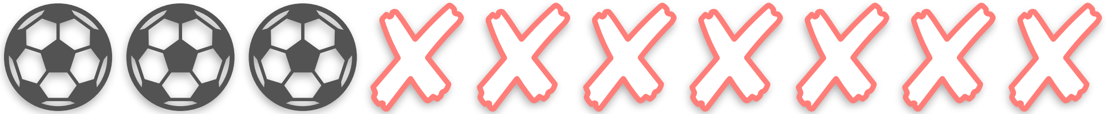

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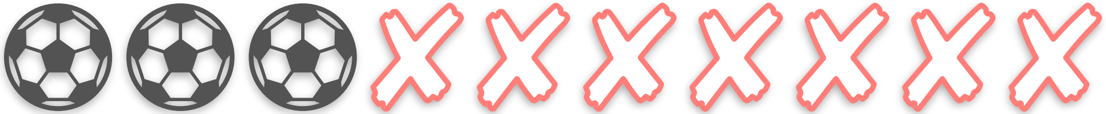

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$$\mathbf{P}(\text{soccer})$$

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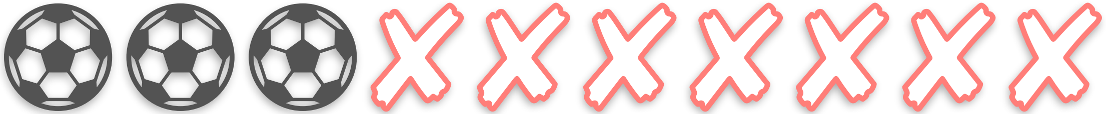

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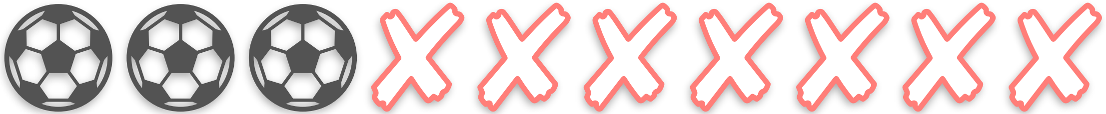

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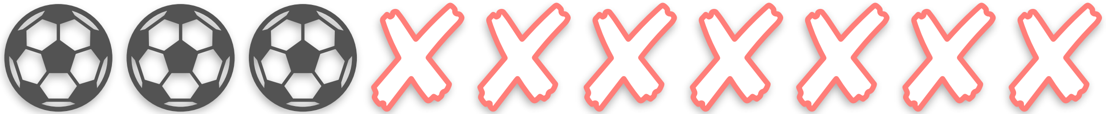

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$$\mathbf{P}(\text{soccer}) = \frac{\text{soccer}}{\text{total}}$$

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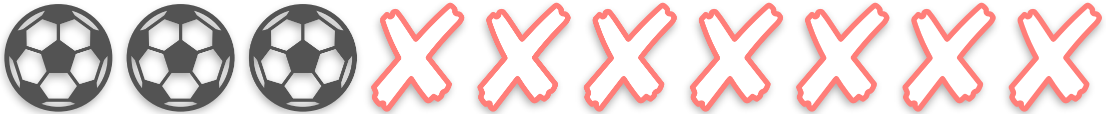

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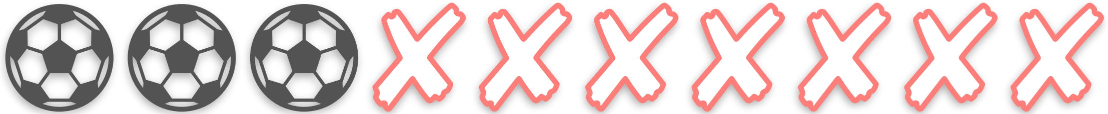

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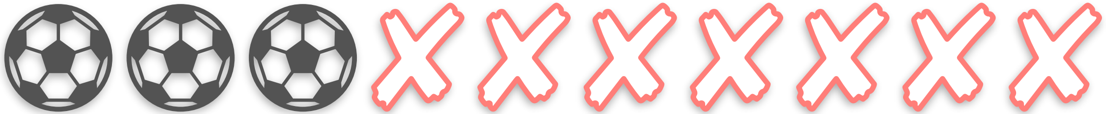

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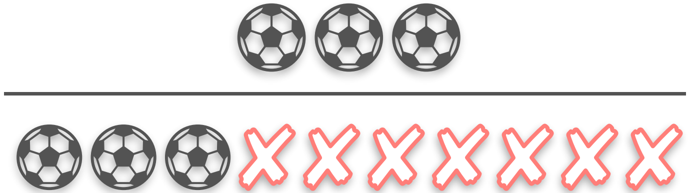

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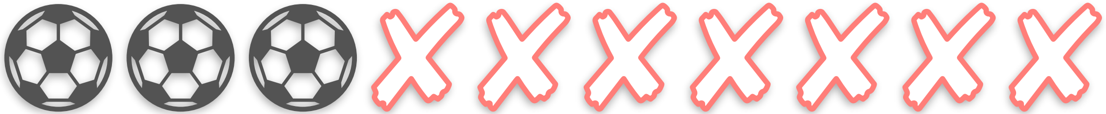

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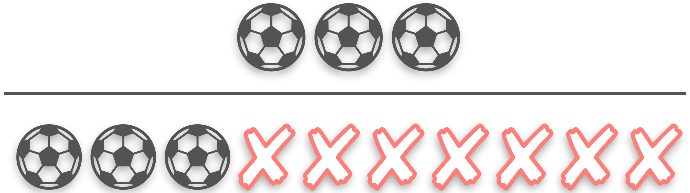

$$= \frac{3}{10}$$

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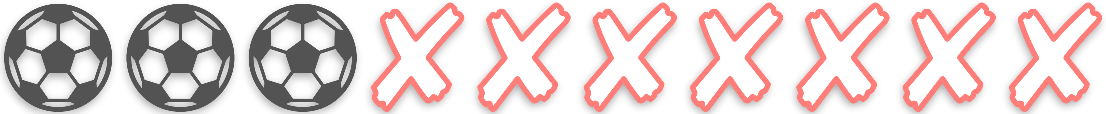

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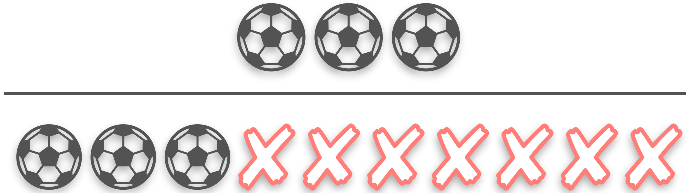

$$= \frac{3}{10} = 0.3$$

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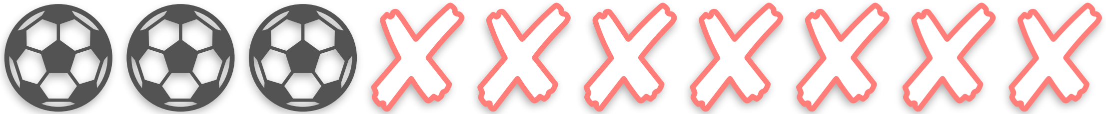

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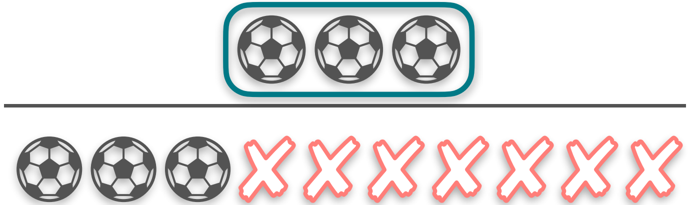

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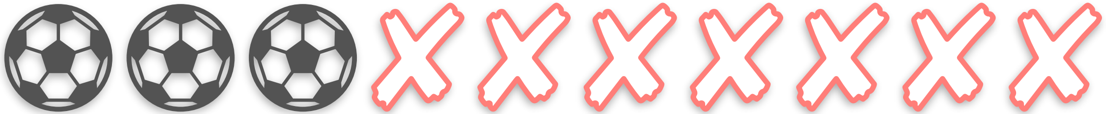

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Event

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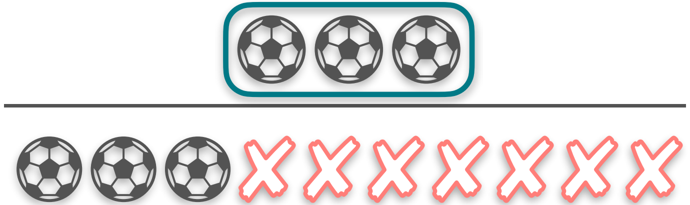

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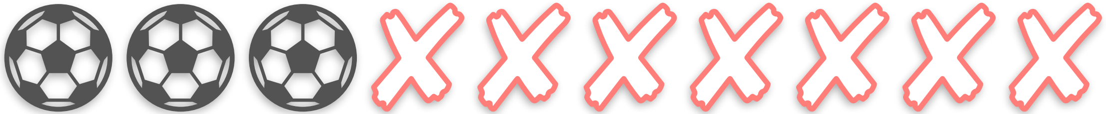

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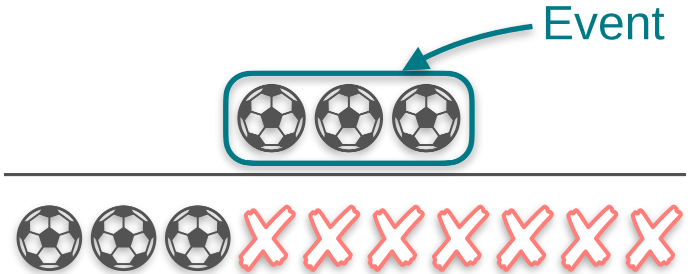

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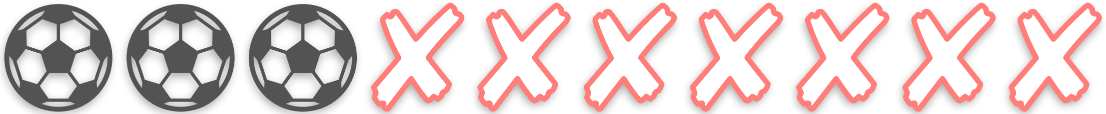

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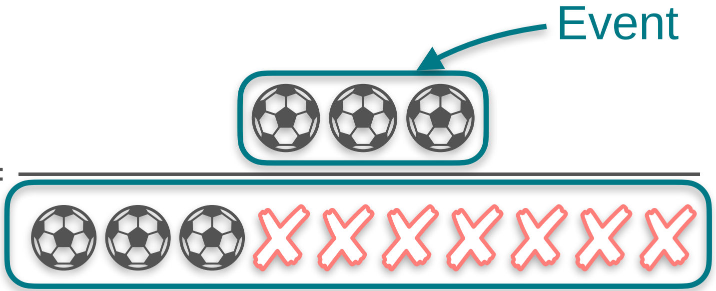

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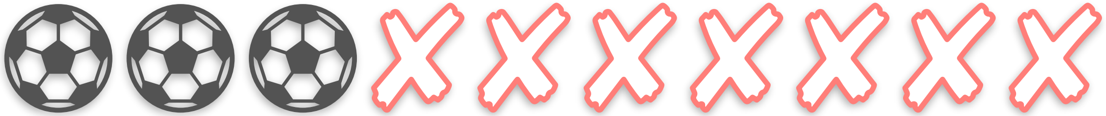

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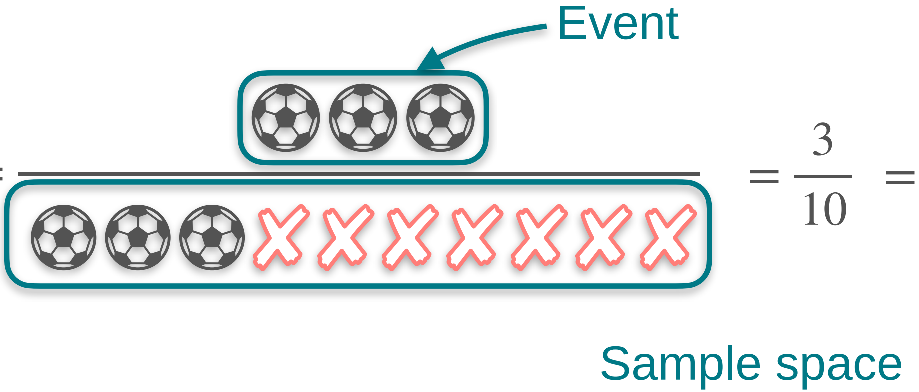

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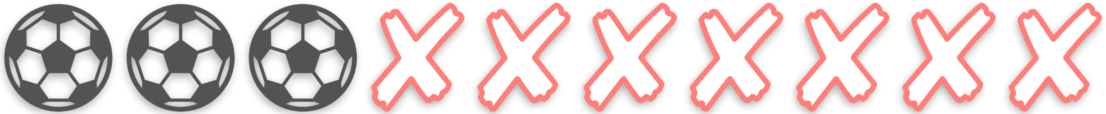

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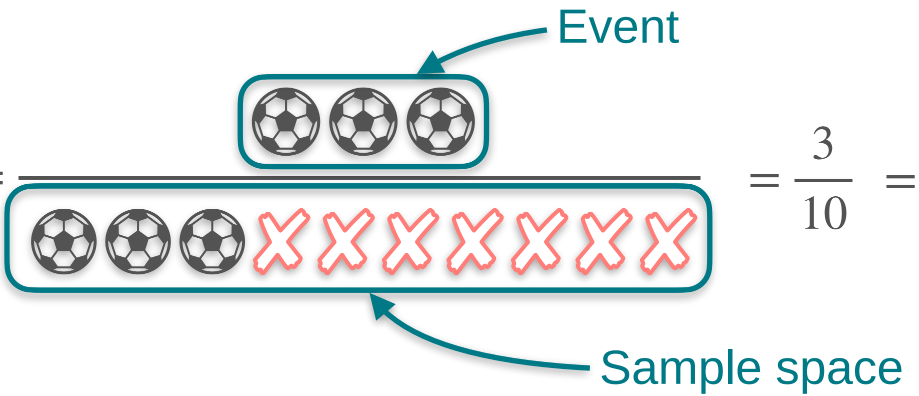

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Introduction to Probability: Venn Diagram

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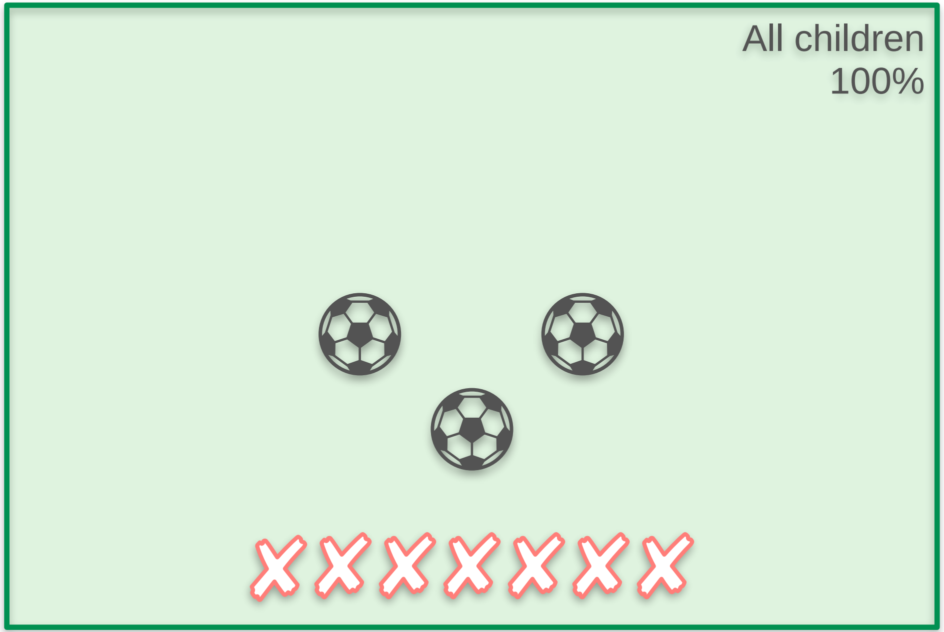

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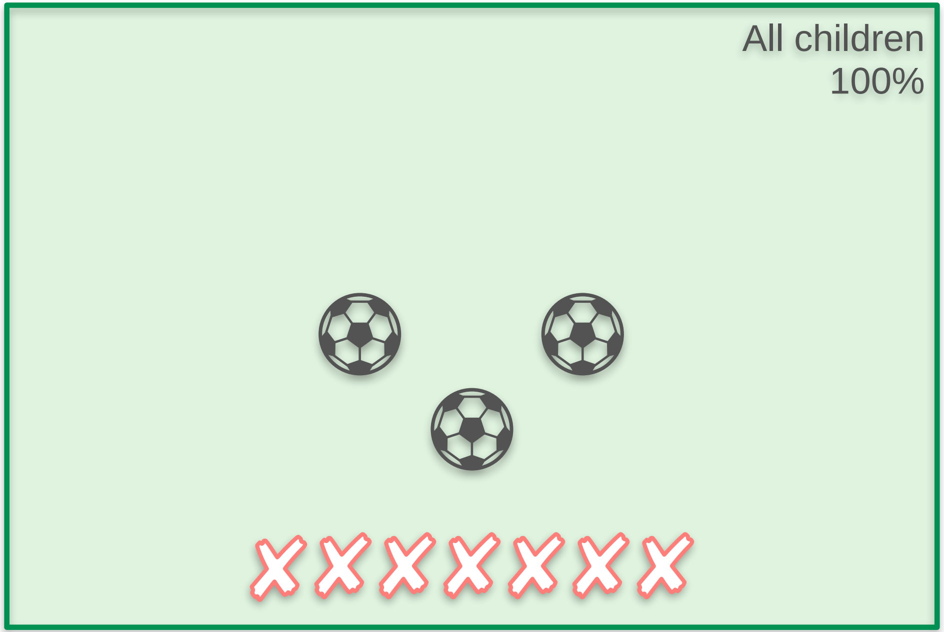
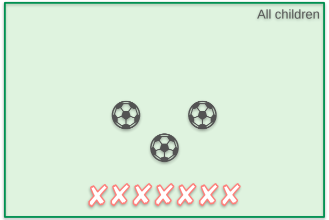
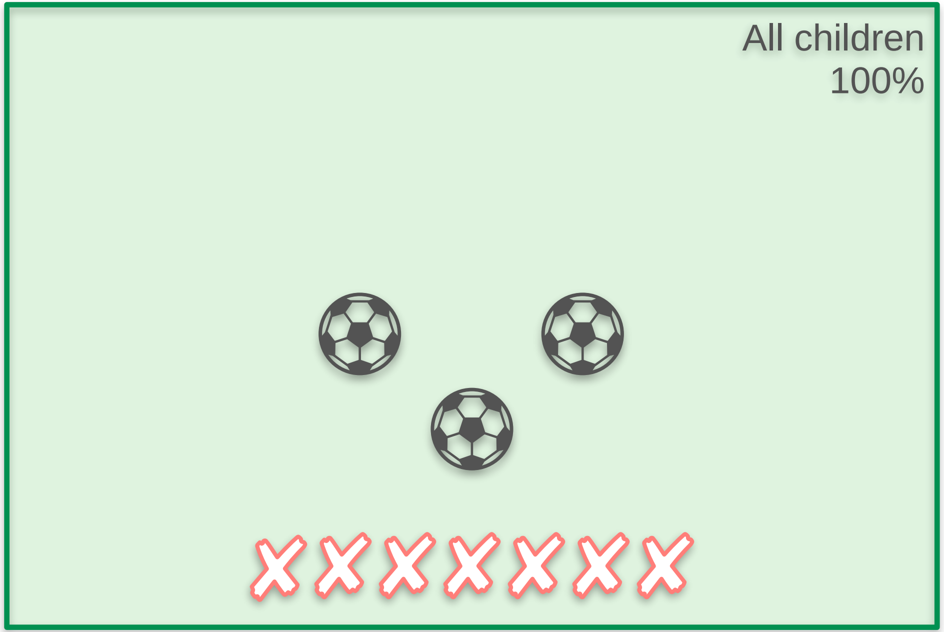
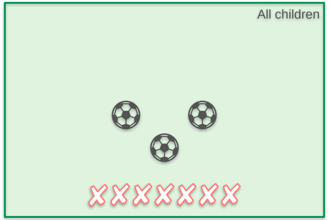




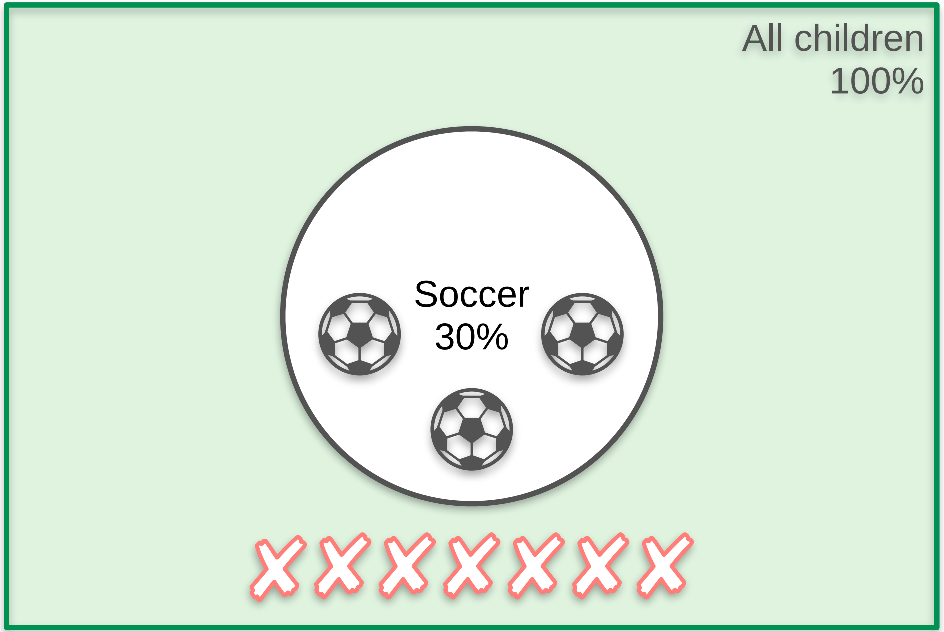
Introduction to Probability: Venn Diagram

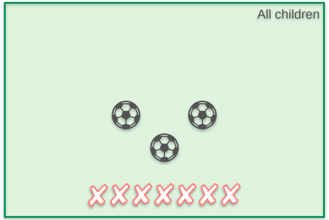




Sample Space

Introduction to Probability: Venn Diagram





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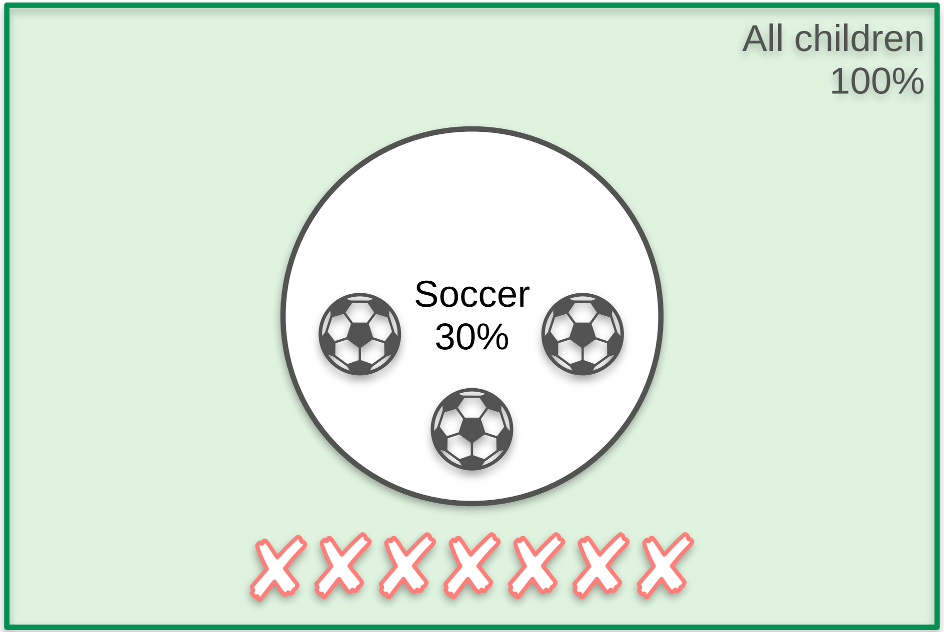
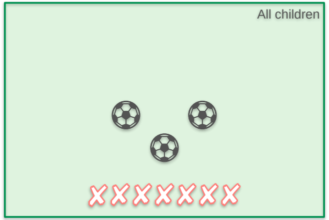
Introduction to Probability: Venn Diagram





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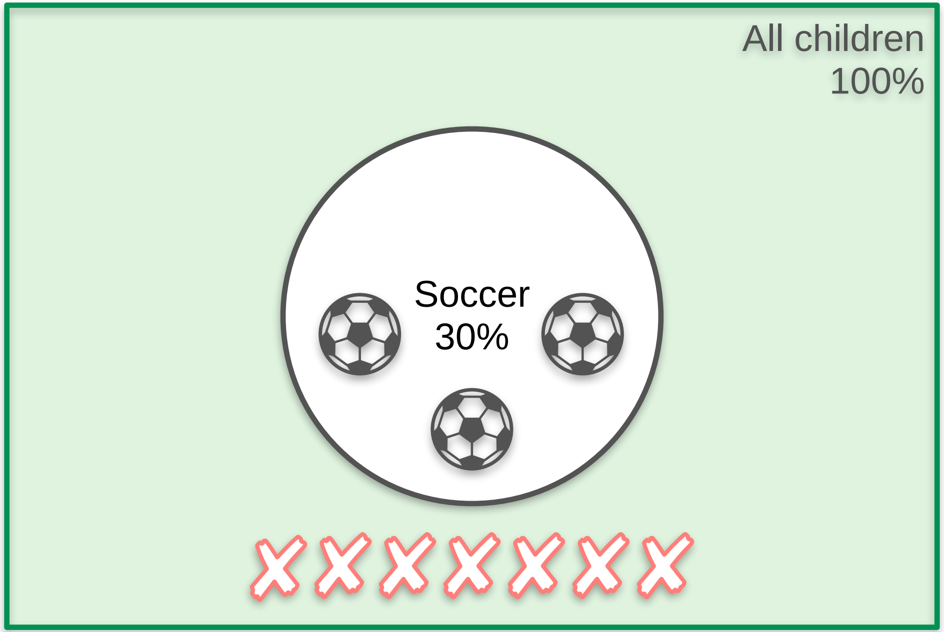
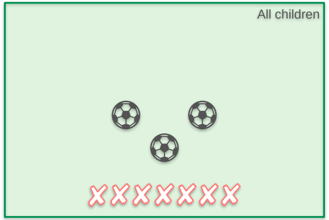




Sample Space

Event

Introduction to Probability: Coin Example 1

Introduction to Probability: Coin Example 1

Introduction to Probability: Coin Example 1

Experiment

Introduction to Probability: Coin Example 1

Experiment

Probability of landing on heads

Introduction to Probability: Coin Example 1

Experiment

Probability of landing on heads

$\mathbf{P}(\text{heads})$

Introduction to Probability: Coin Example 1

Introduction to Probability: Coin Example 1

Introduction to Probability: Coin Example 1

50%

Introduction to Probability: Coin Example 1

50% 50%

Introduction to Probability: Coin Example 1

50%   50%

$$\mathbf{P}(\text{heads}) = \underline{\hspace{6cm}}$$

Introduction to Probability: Coin Example 1

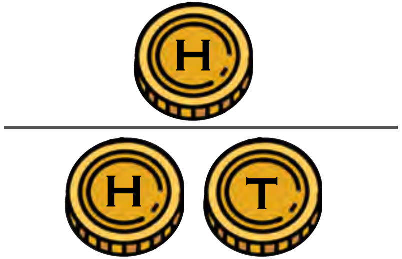
50% 50%

$\mathbf{P}(\text{heads}) =$

Introduction to Probability: Coin Example 1

50% 50%

$\mathbf{P}(\text{heads}) =$



Introduction to Probability: Coin Example 1

50% 50%

$\mathbf{P}(\text{heads}) =$

$= \frac{1}{2} = 0.5$

Introduction to Probability: Coin Example 2

50% 50%

Introduction to Probability: Coin Example 2

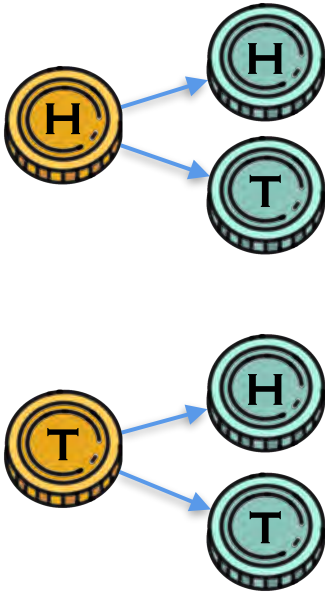
50% 50%

1st

Introduction to Probability: Coin Example 2

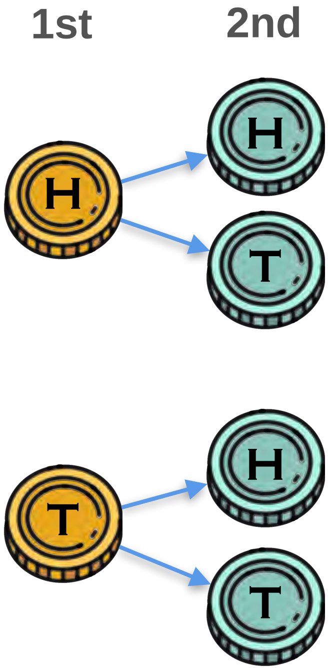
50% 50%

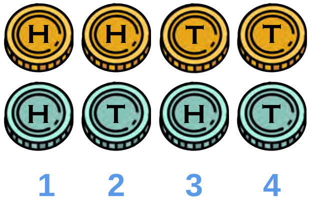
1st 2nd



Introduction to Probability: Coin Example 2

50%   50%

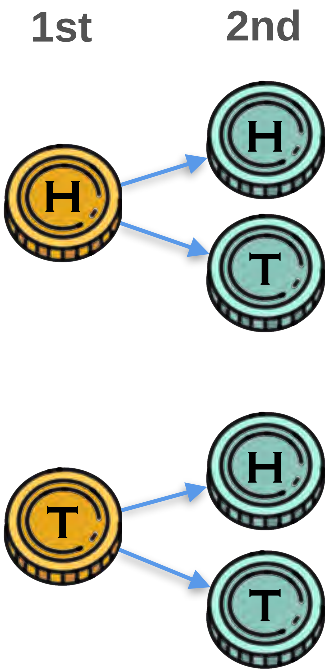




Introduction to Probability: Coin Example 2

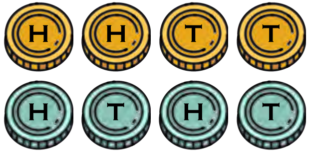
50% 50%

What is the probability of landing on heads twice?



Introduction to Probability: Coin Example 2

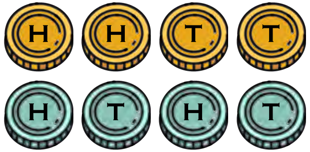
50% 50%



Introduction to Probability: Coin Example 2

50% 50%

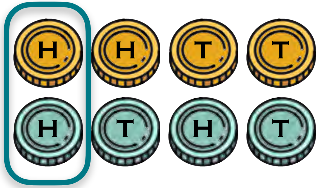
$$\mathbf{P}(HH) = \underline{\hspace{8cm}}$$



Introduction to Probability: Coin Example 2

50% 50%

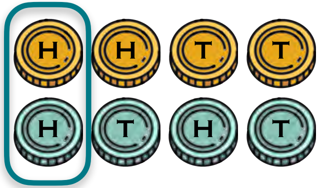
$$\mathbf{P}(HH) = \underline{\hspace{6cm}}$$



Introduction to Probability: Coin Example 2

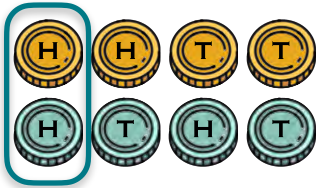
50% 50%

$$\mathbf{P}(HH) = \underline{\qquad\qquad}$$

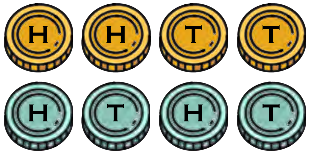


Introduction to Probability: Coin Example 2

50% 50%



$$P(HH) =$$



Introduction to Probability: Coin Example 2

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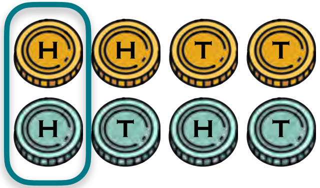
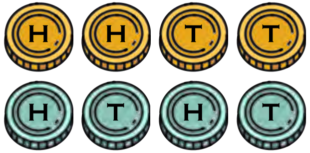


$\mathbf{P}(HH) =$



$= \frac{1}{4} = 0.25$

Introduction to Probability: Coin Example 3

50% 50%

Introduction to Probability: Coin Example 3

50% 50%

1st

Introduction to Probability: Coin Example 3

50% 50%

1st

Introduction to Probability: Coin Example 3

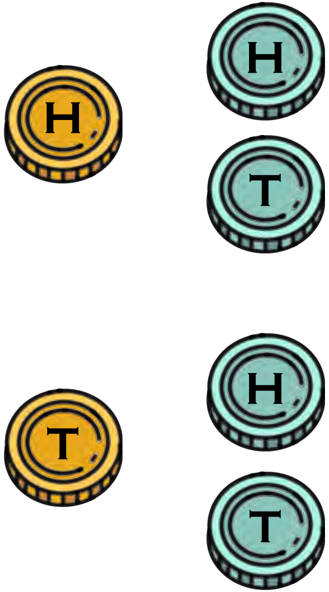
50% 50%

1st 2nd

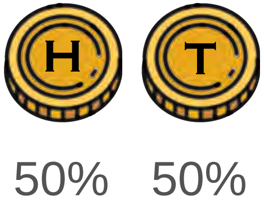
Introduction to Probability: Coin Example 3

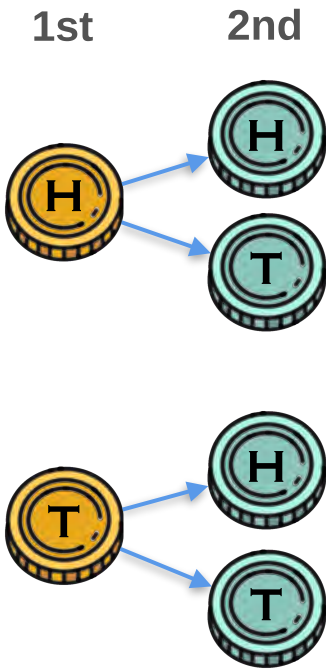
50% 50%

1st 2nd



Introduction to Probability: Coin Example 3





Introduction to Probability: Coin Example 3

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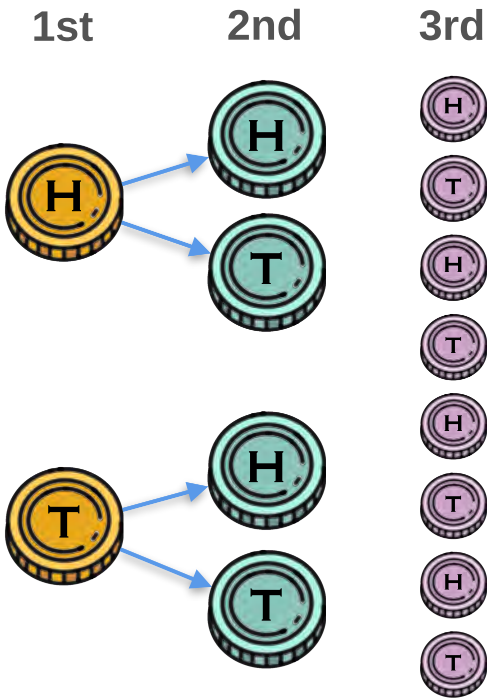

Introduction to Probability: Coin Example 3

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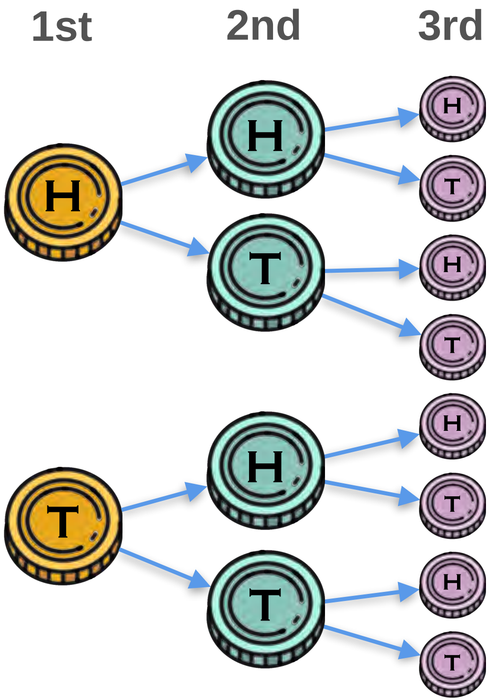
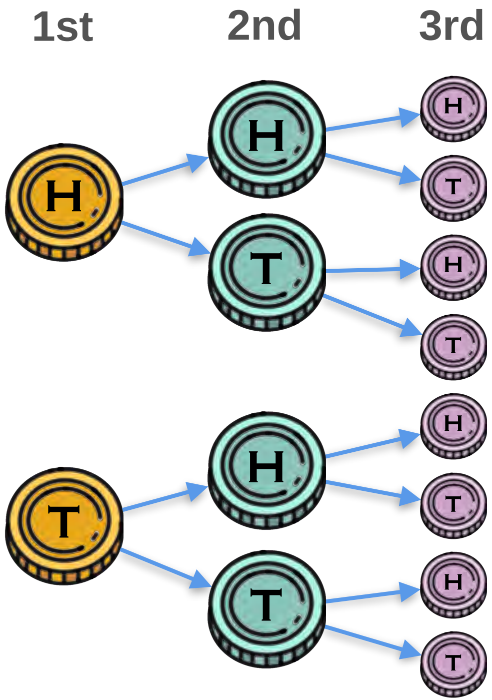


Introduction to Probability: Coin Example 3

50% 50%



Introduction to Probability: Coin Example 3

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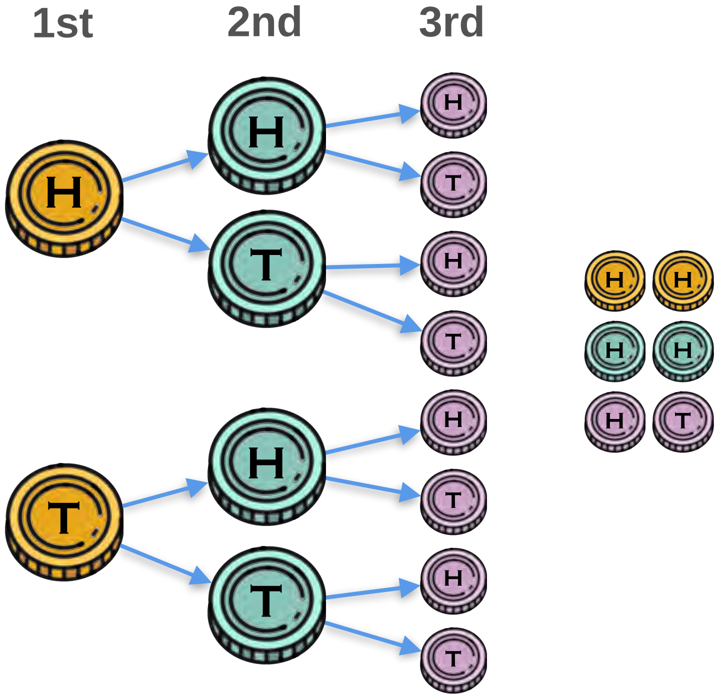
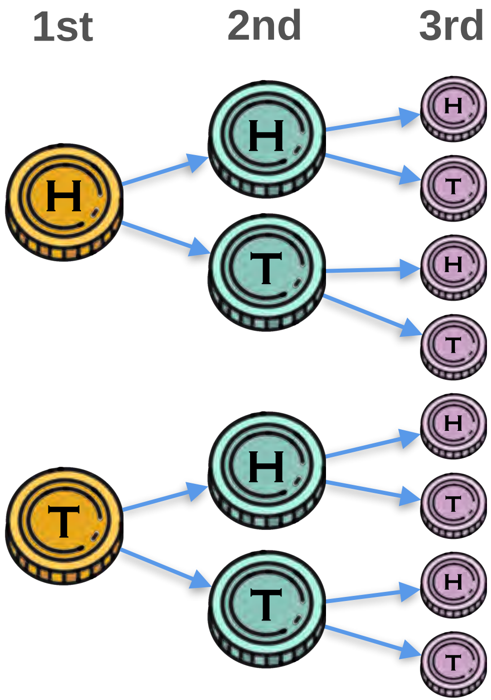
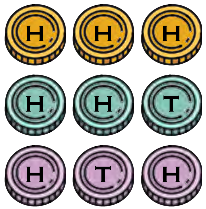


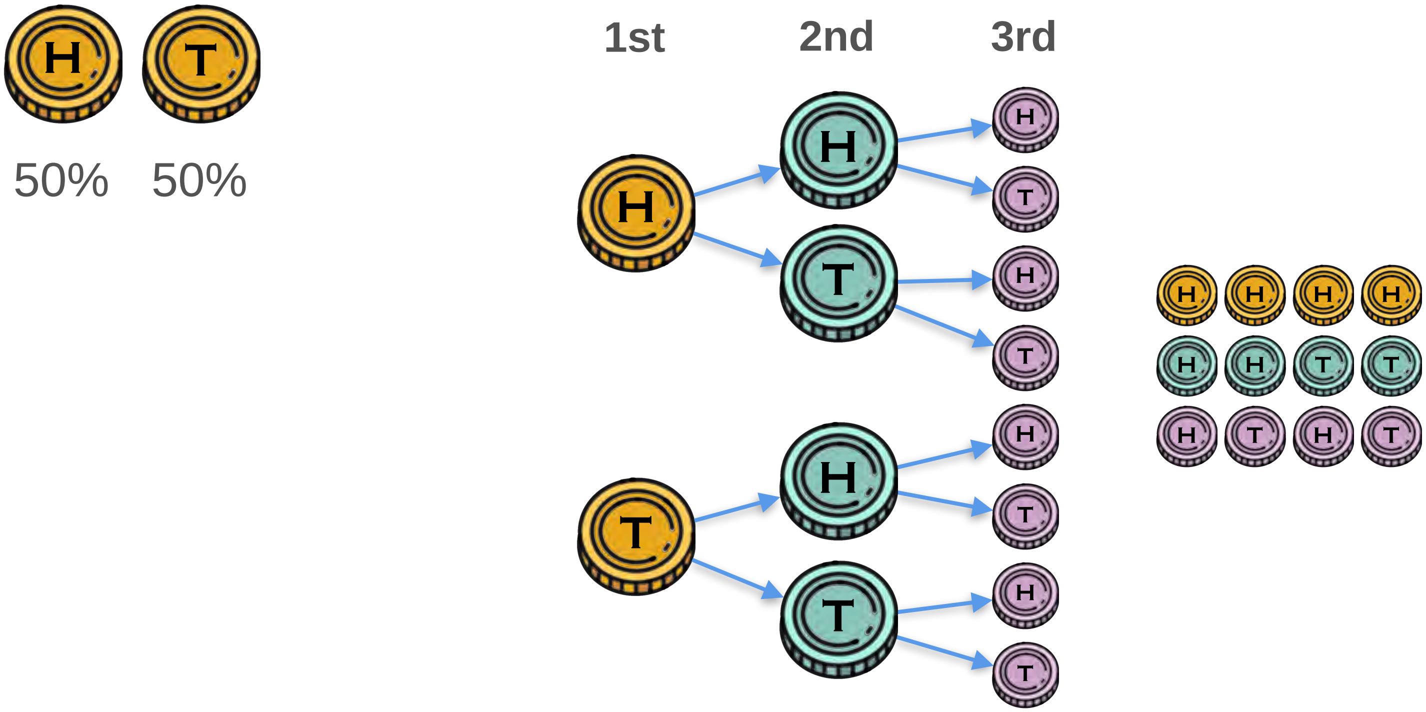
Introduction to Probability: Coin Example 3

50% 50%





Introduction to Probability: Coin Example 3



Introduction to Probability: Coin Example 3

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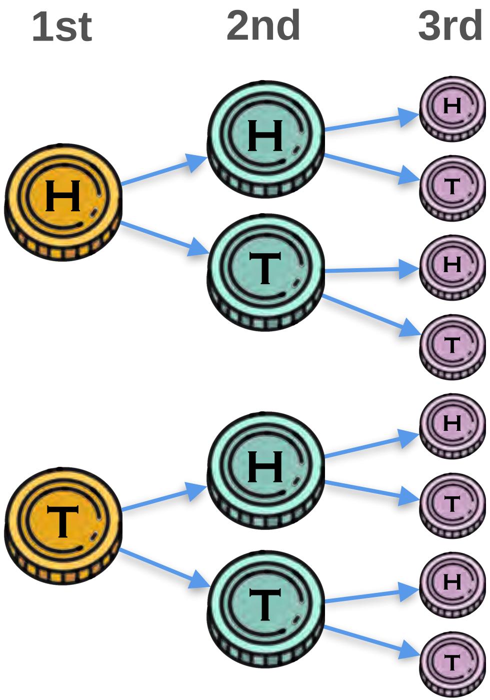

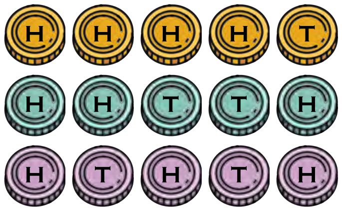

Introduction to Probability: Coin Example 3

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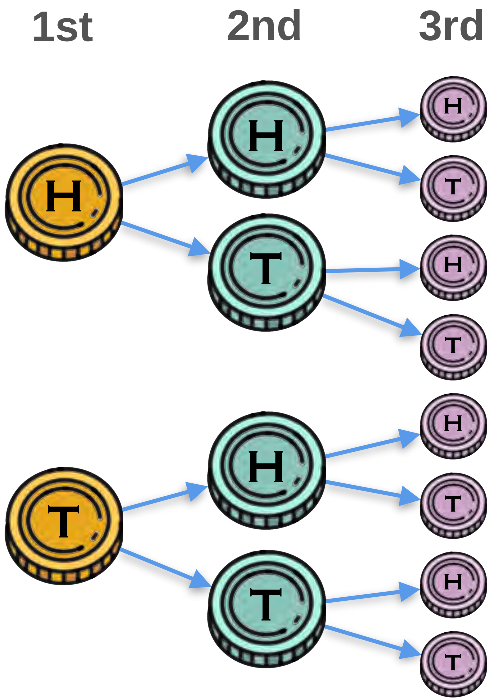

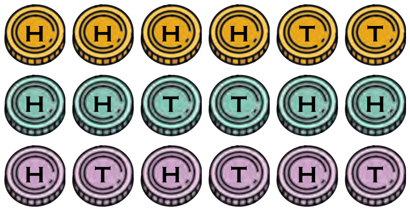

Introduction to Probability: Coin Example 3

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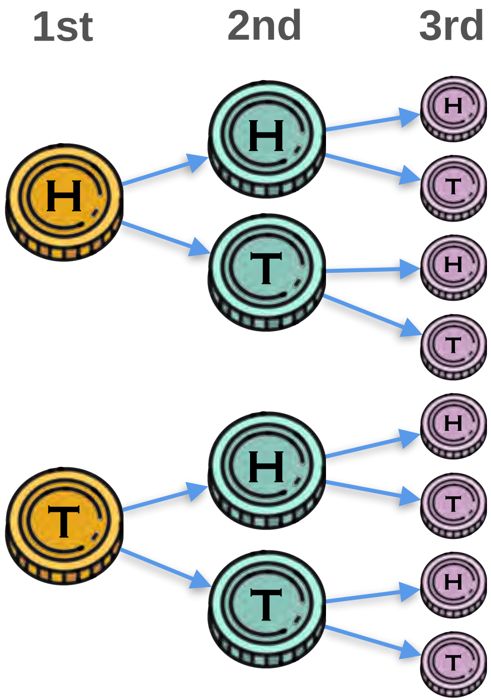

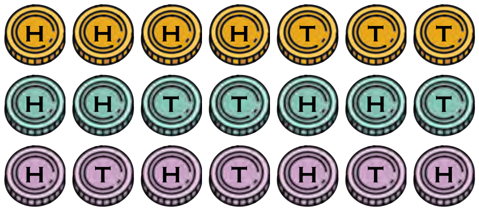

Introduction to Probability: Coin Example 3

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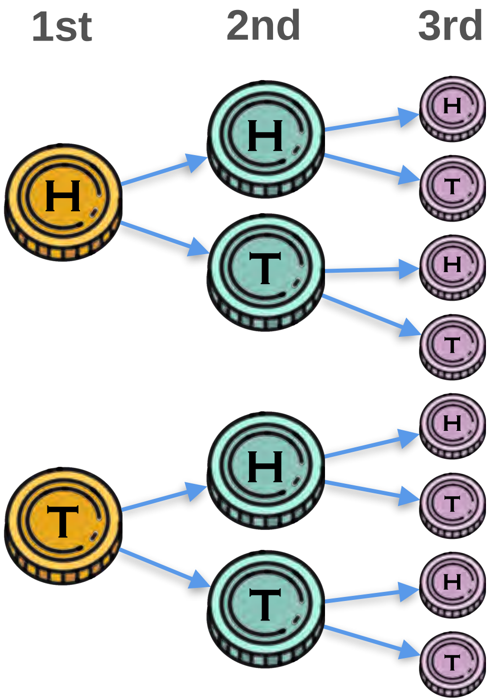

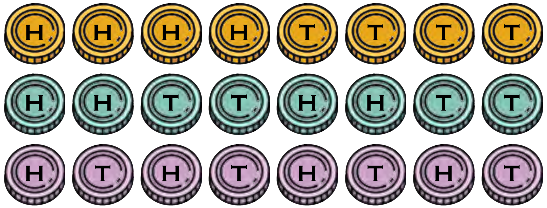

Introduction to Probability: Coin Example 3

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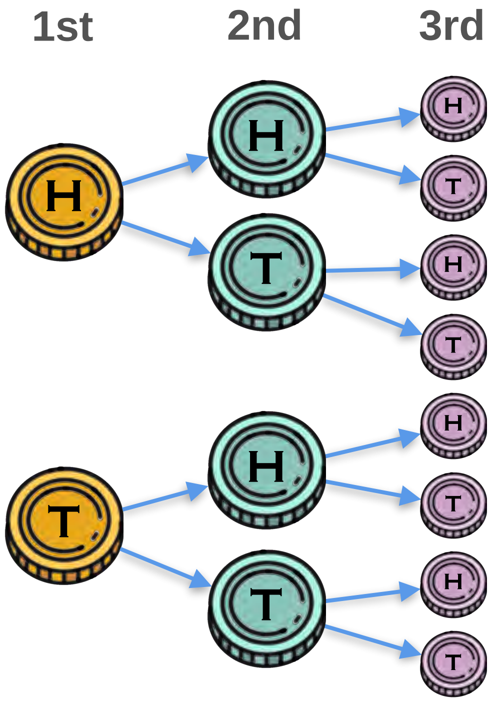
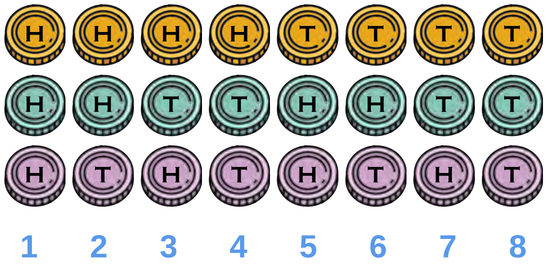
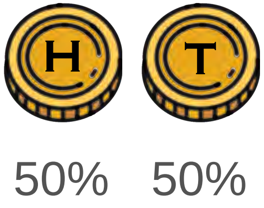
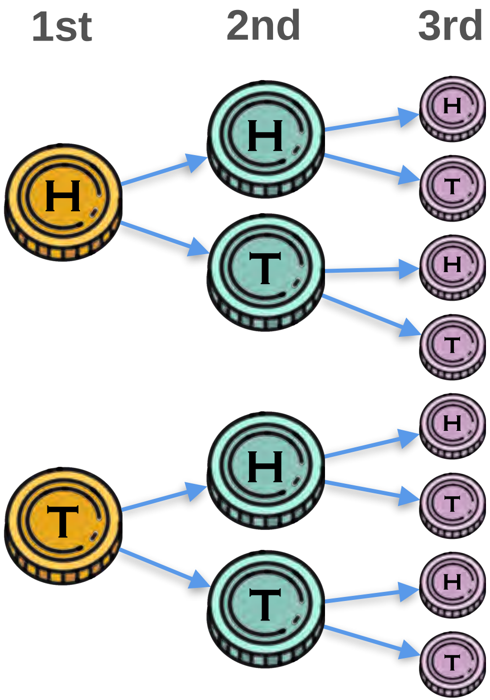
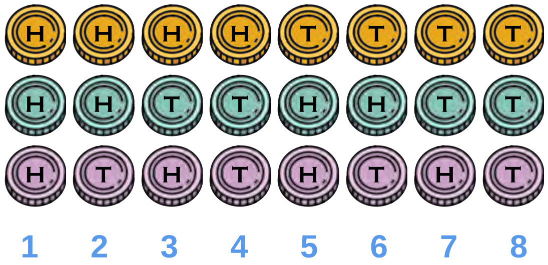




Introduction to Probability: Coin Example 3



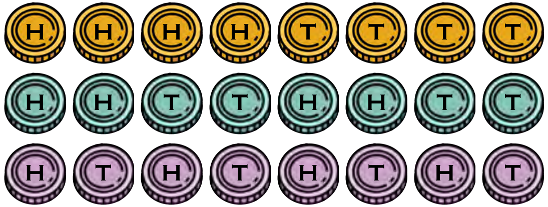




What is the probability of landing on heads 3 times?

Introduction to Probability: Coin Example 3

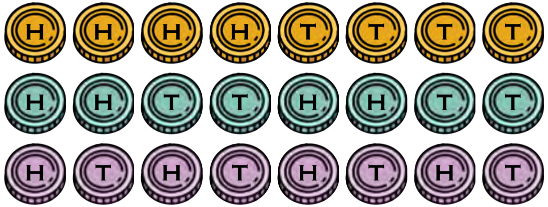
50% 50%



Introduction to Probability: Coin Example 3

50% 50%

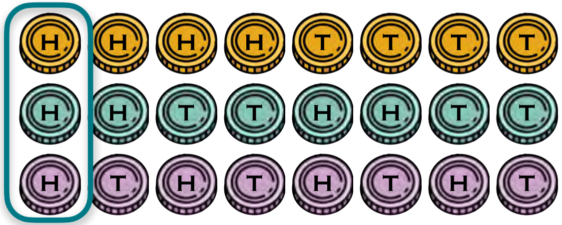
$$\mathbf{P}(HHH) = \underline{\hspace{6cm}}$$



Introduction to Probability: Coin Example 3

50% 50%

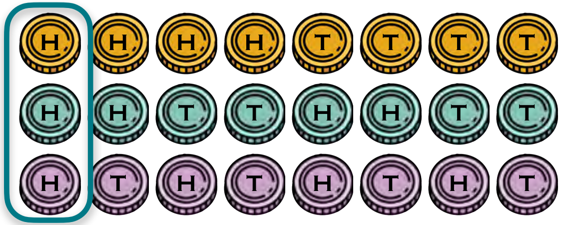
$$\mathbf{P}(HHH) = \underline{\hspace{8cm}}$$



Introduction to Probability: Coin Example 3

50%   50%

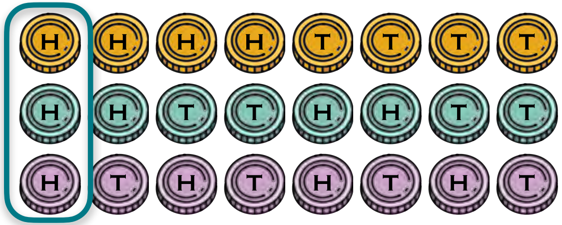
$$\mathbf{P}(HHH) = \frac{\qquad}{\qquad}$$



Introduction to Probability: Coin Example 3

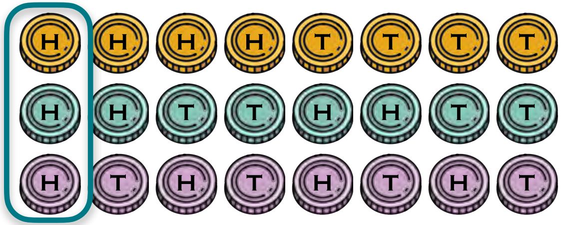
50% 50%

$P(HHH) =$

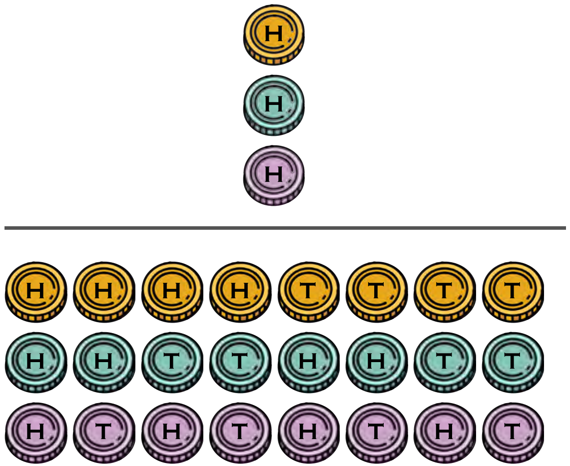


Introduction to Probability: Coin Example 3

50% 50%



$\mathbf{P}(HHH) =$



$= \frac{1}{8} = 0.125$

Introduction to Probability: Dice Example 1

Introduction to Probability: Dice Example 1

Introduction to Probability: Dice Example 1

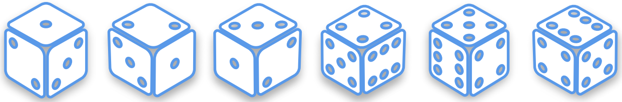
What is the probability of obtaining 6?

Introduction to Probability: Dice Example 1

What is the probability of obtaining 6?

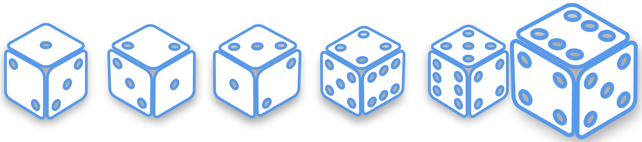
Introduction to Probability: Dice Example 1

What is the probability of obtaining 6?

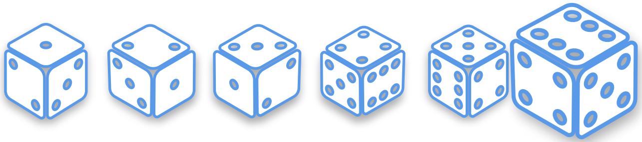


Introduction to Probability: Dice Example 1

What is the probability of obtaining 6?



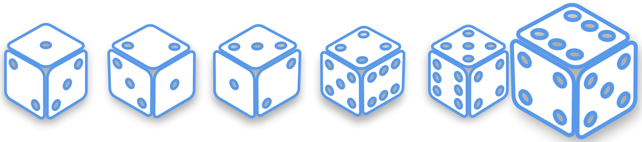
Introduction to Probability: Dice Example 1



What is the probability of obtaining 6?

$\mathbf{P}(6) = \underline{\hspace{6cm}}$

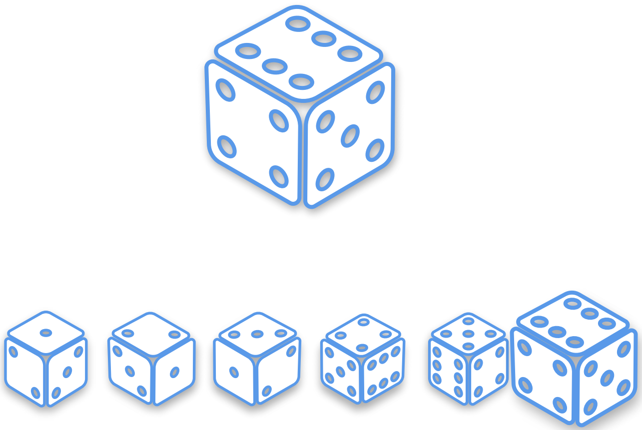
Introduction to Probability: Dice Example 1



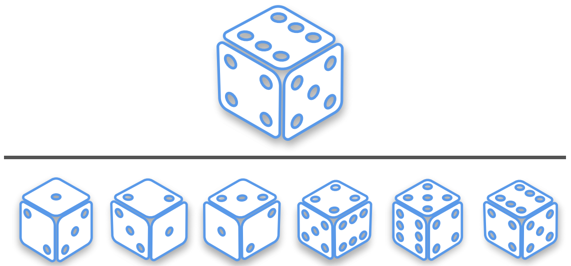
What is the probability of obtaining 6?

$$\mathbf{P}(6) = \frac{\quad}{\quad}$$

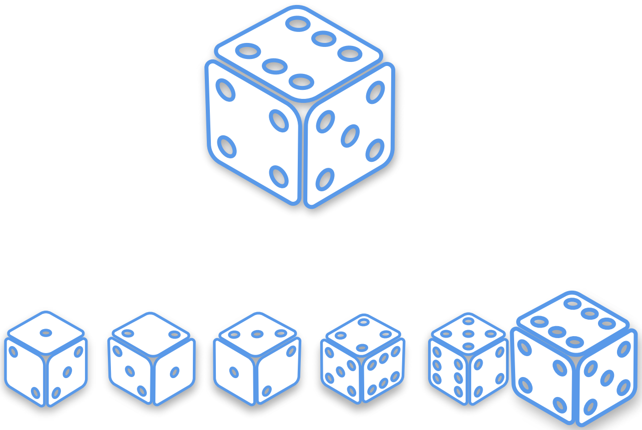
Introduction to Probability: Dice Example 1



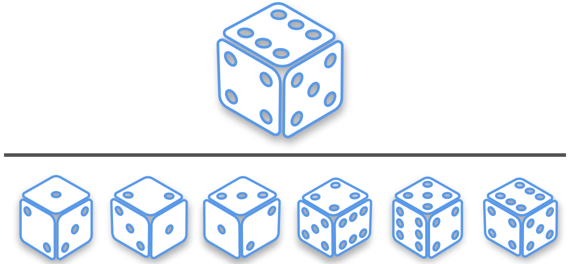
What is the probability of obtaining 6?

$\mathbf{P}(6) =$ 

Introduction to Probability: Dice Example 1



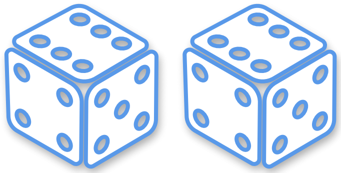
What is the probability of obtaining 6?



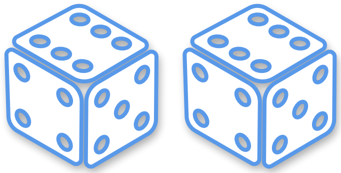
$$\mathbf{P}(6) = \frac{1}{6}$$

Introduction to Probability: Dice Example 2

Introduction to Probability: Dice Example 2

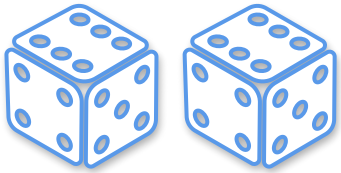


Introduction to Probability: Dice Example 2



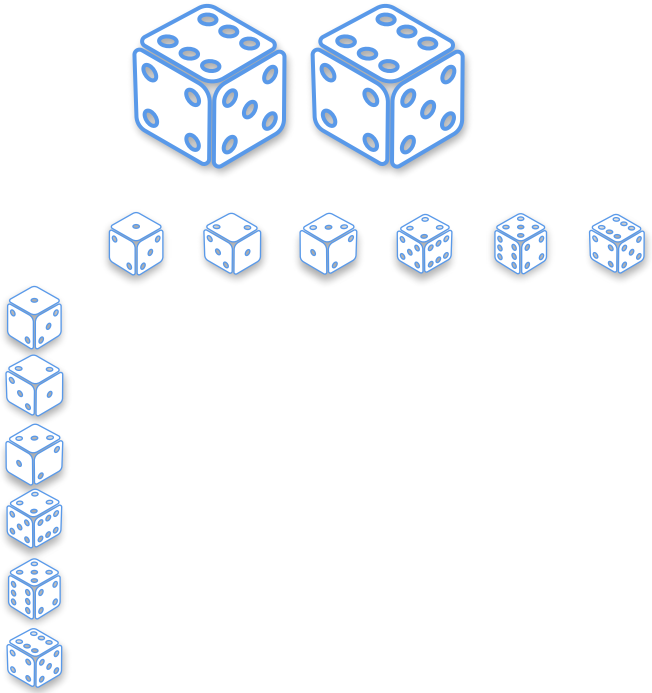
What is the probability of obtaining 6,6?

Introduction to Probability: Dice Example 2



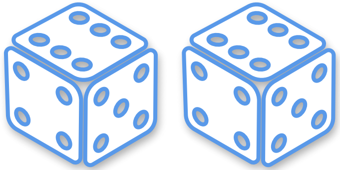
What is the probability of obtaining 6,6?

Introduction to Probability: Dice Example 2



What is the probability of obtaining 6,6?

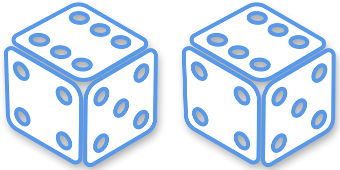
Introduction to Probability: Dice Example 2



What is the probability of obtaining 6,6?

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

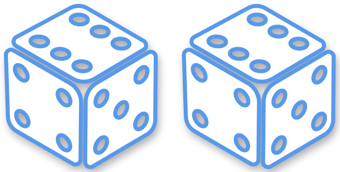
Introduction to Probability: Dice Example 2



What is the probability of obtaining 6,6?

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	$\boxed{6,6}$

Introduction to Probability: Dice Example 2

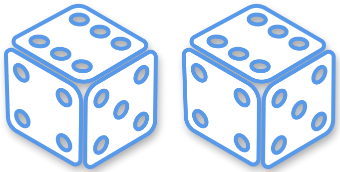


1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

What is the probability of obtaining 6,6?

$$\mathbf{P}(6,6) = \rule{6cm}{0.4pt}$$

Introduction to Probability: Dice Example 2

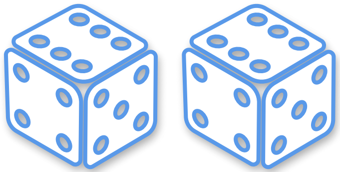


What is the probability of obtaining 6,6?

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$$\mathbf{P}(6,6) = \frac{\boxed{6,6}}{}$$

Introduction to Probability: Dice Example 2



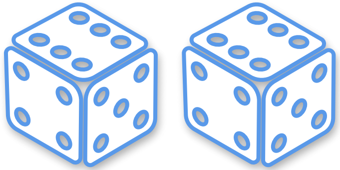
1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

What is the probability of obtaining 6,6?

$$\mathbf{P}(6{,}6) = \frac{\boxed{6{,}6}}{\text{(table below)}}$$

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

Introduction to Probability: Dice Example 2



1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

What is the probability of obtaining 6,6?

$$\mathbf{P}(6,6) = \frac{\boxed{6,6}}{\text{(all outcomes below)}} = \frac{1}{36}$$

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

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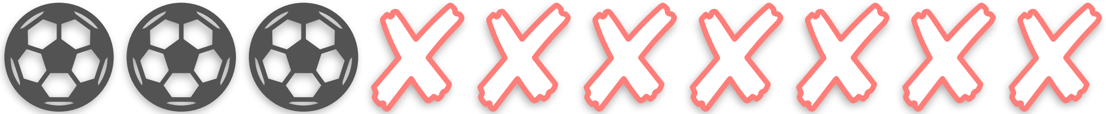
Introduction to probability

Complement of Probability

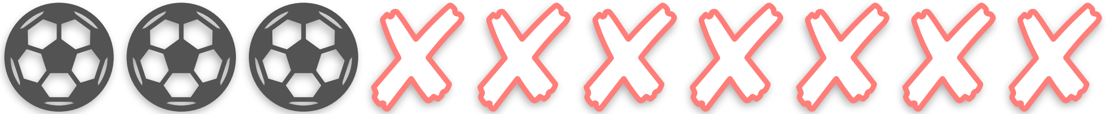
Complement of Probability

Complement of Probability



30%

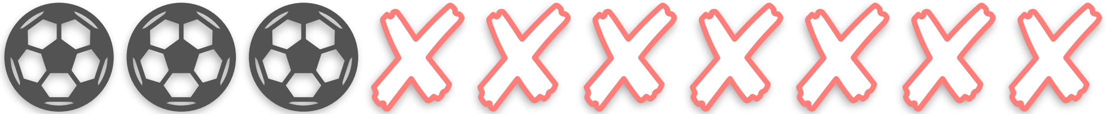
Complement of Probability



30%

What is the probability of a child NOT playing soccer?

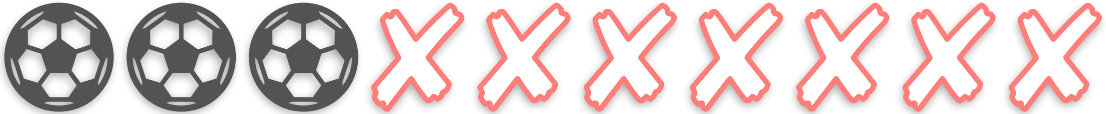
Complement of Probability



30%

What is the probability of a child NOT playing soccer?

Complement of Probability

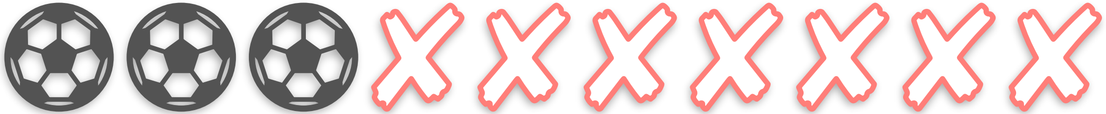


30%

What is the probability of a child NOT playing soccer?

$$\mathbf{P}(\text{not soccer}) = \frac{\text{not soccer}}{\text{total}}$$

Complement of Probability

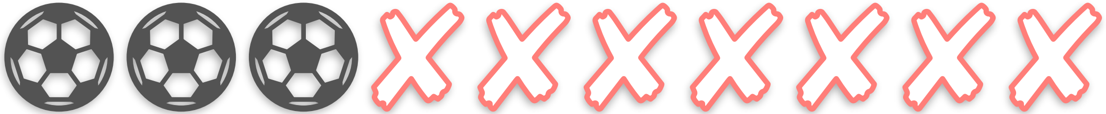


30%

What is the probability of a child NOT playing soccer?

$$\mathbf{P}(\text{not soccer}) = \frac{\text{not soccer}}{\text{total}} = \underline{\hspace{10cm}}$$

Complement of Probability

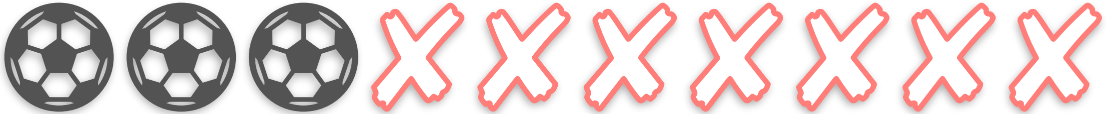


30%

What is the probability of a child NOT playing soccer?

$$\mathbf{P}(\text{not soccer}) = \frac{\text{not soccer}}{\text{total}} = $$

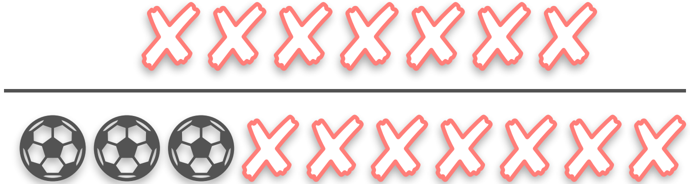
Complement of Probability



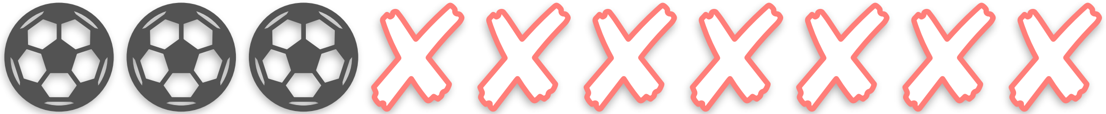
30%

What is the probability of a child NOT playing soccer?

$$\mathbf{P}(\text{not soccer}) = \frac{\text{not soccer}}{\text{total}} =$$



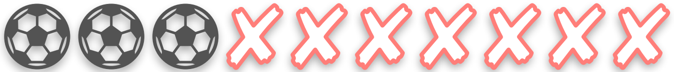
Complement of Probability



30%

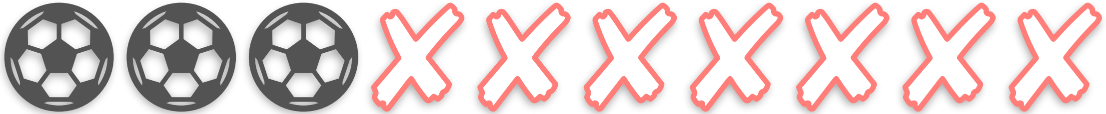
What is the probability of a child NOT playing soccer?

$$\mathbf{P}(\text{not soccer}) = \frac{\text{not soccer}}{\text{total}} =$$



$$= \frac{7}{10}$$

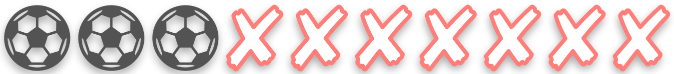
Complement of Probability



30%

What is the probability of a child NOT playing soccer?

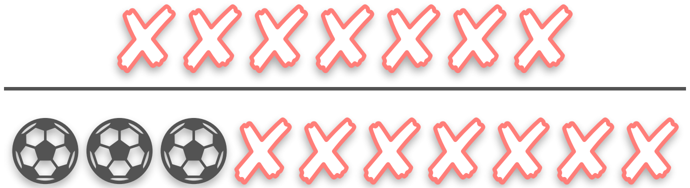
$$\mathbf{P}(\text{not soccer}) = \frac{\text{not soccer}}{\text{total}} =$$



$$= \frac{7}{10} = 0.7$$

Complement of Probability

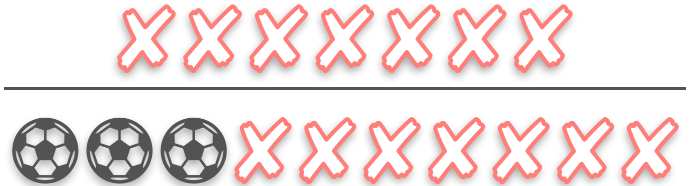
Complement of Probability

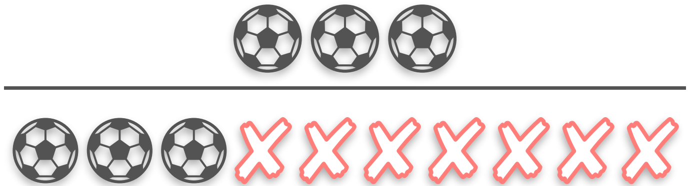


$$\mathbf{P}(\text{not soccer})$$

$$0.7$$

Complement of Probability

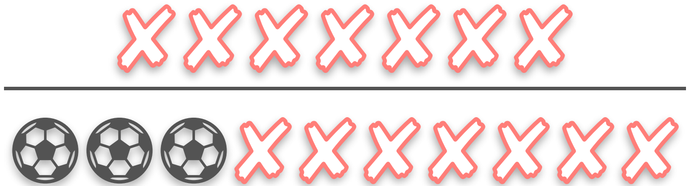


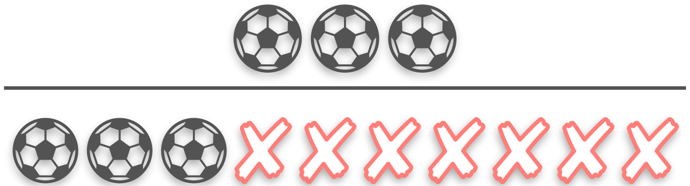


$\mathbf{P}$(not soccer) $\mathbf{P}$(soccer)

0.7 0.3

Complement of Probability

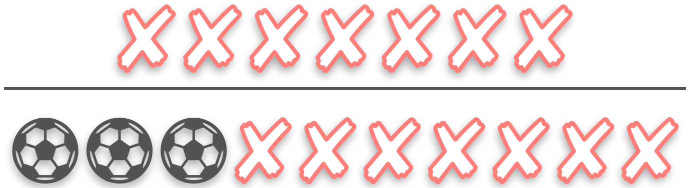


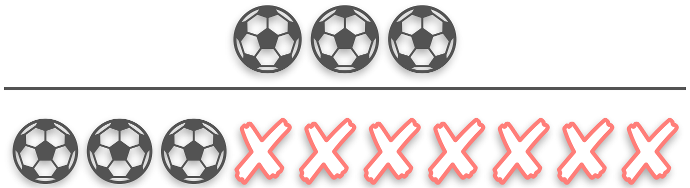


$\mathbf{P}(\text{not soccer})$ $\mathbf{P}(\text{soccer})$

$$0.7 + 0.3 = 1$$

Complement of Probability

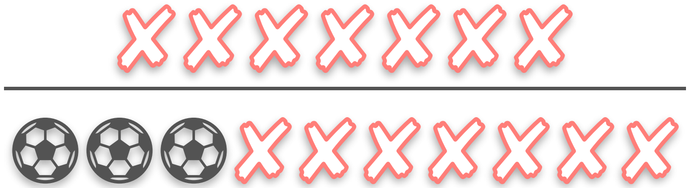


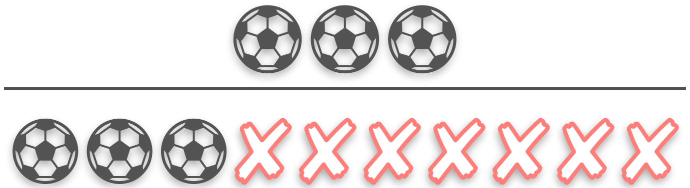


$\mathbf{P}(\text{not soccer})$ $\qquad$ $\mathbf{P}(\text{soccer})$

$0.7 \quad = \quad 1 \qquad 0.3$

Complement of Probability

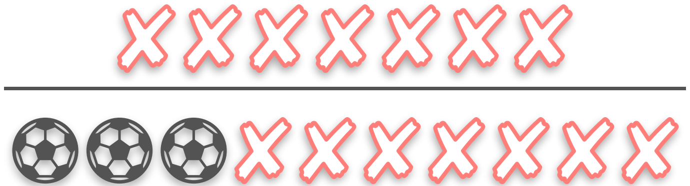


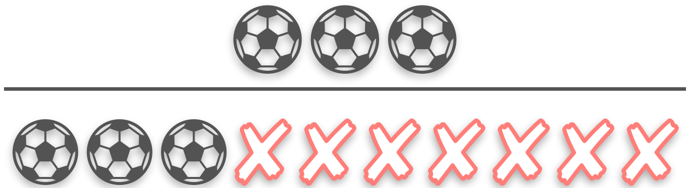


P(not soccer) **P**(soccer)

$$0.7 = 1 - 0.3$$

Complement of Probability





$$\mathbf{P}(\text{not soccer}) = 1 - \mathbf{P}(\text{soccer})$$

$$0.7 = 1 - 0.3$$

Complement of Probability

$$\boxed{\mathbf{P}(\text{not soccer}) = 1 - \mathbf{P}(\text{soccer})}$$

$$0.7 = 1 - 0.3$$

Complement of Probability

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$$0.7 = 1 - 0.3$$

Complement Rule

Complement of Probability

$$\mathbf{P}(\text{not soccer}) = 1 - \mathbf{P}(\text{soccer})$$

Complement Rule

Complement of Probability

$$\boxed{\mathbf{P}(\text{not soccer}) = 1 - \mathbf{P}(\text{soccer})}$$

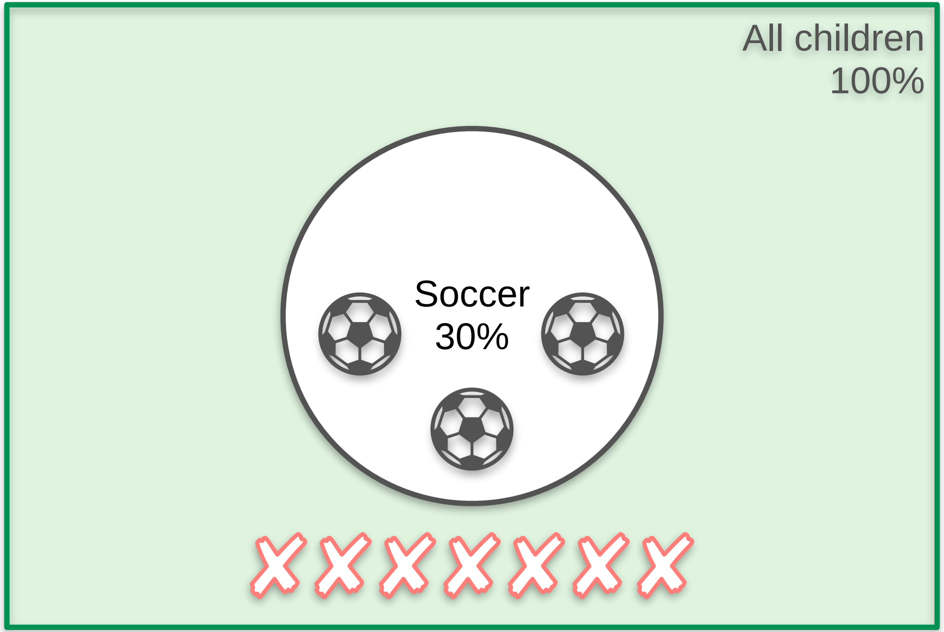
$$\mathbf{P}(A') = 1 - \mathbf{P}(A)$$

Complement Rule

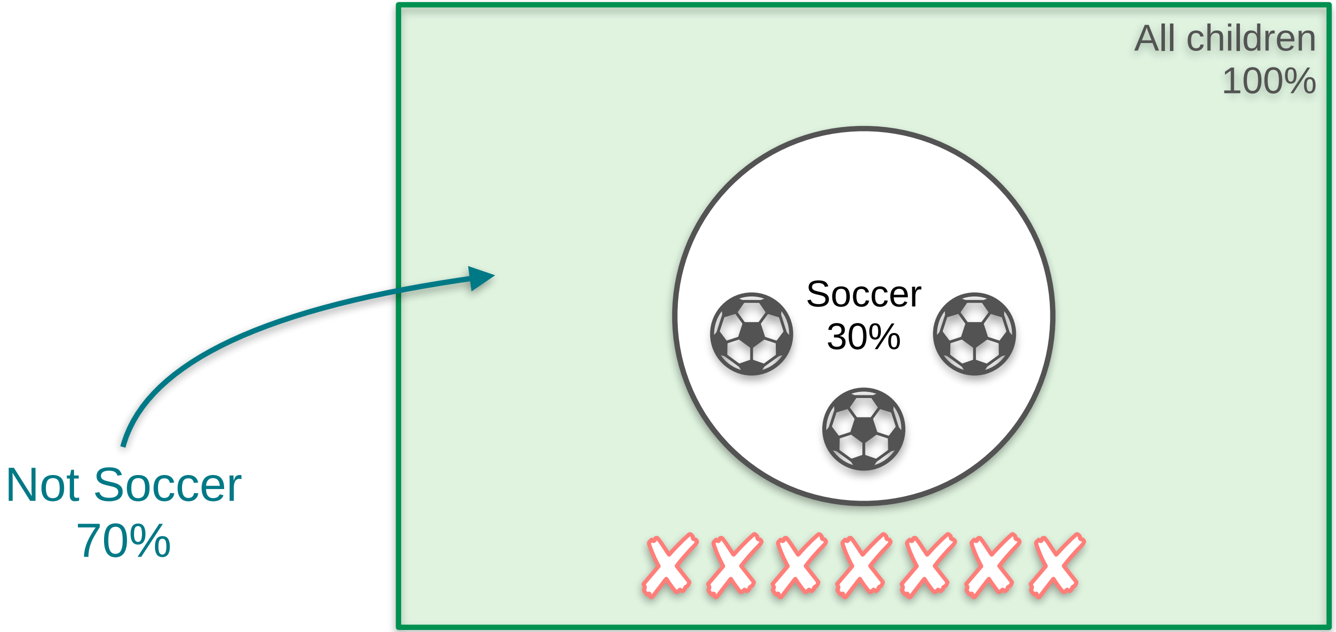
Complement of Probability: Venn Diagram

Complement of Probability: Venn Diagram

Complement of Probability: Venn Diagram



Complement of Probability: Venn Diagram



Complement of Probability: Coin Example 1

Complement of Probability: Coin Example 1

What is the probability of not landing on heads 3 times?

Complement of Probability: Coin Example 1

What is the probability of not landing on heads 3 times?

Complement of Probability: Coin Example 1

What is the probability of not landing on heads 3 times?

$$\mathbf{P}(\text{not } HHH)$$

Complement of Probability: Coin Example 1

What is the probability of not landing on heads 3 times?

$$\mathbf{P}(\text{not } HHH) =$$

Complement of Probability: Coin Example 1

What is the probability of not landing on heads 3 times?

$$\mathbf{P}(\text{not } HHH) = 1$$

Complement of Probability: Coin Example 1

What is the probability of not landing on heads 3 times?

$$\mathbf{P}(\text{not } HHH) = 1 - \mathbf{P}(HHH)$$

Complement of Probability: Coin Example 1

What is the probability of not landing on heads 3 times?

$$\mathbf{P}(\text{not } HHH) = 1 - \mathbf{P}(HHH)$$

$$\mathbf{P}(HHH) =$$

Complement of Probability: Coin Example 1

What is the probability of not landing on heads 3 times?

$$\mathbf{P}(\text{not } HHH) = 1 - \mathbf{P}(HHH)$$

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Complement of Probability: Coin Example 1

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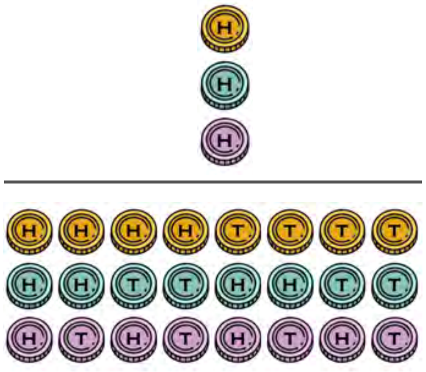
$$\mathbf{P}(\text{not } HHH) = 1 - \mathbf{P}(HHH)$$

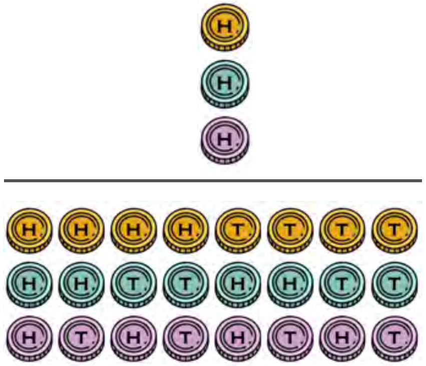


Complement of Probability: Coin Example 1

What is the probability of not landing on heads 3 times?

$$\mathbf{P}(\text{not } HHH) = 1 - \mathbf{P}(HHH)$$

$$\mathbf{P}(\text{not } HHH) = 1 -$$



Complement of Probability: Coin Example 1

What is the probability of not landing on heads 3 times?

$$\mathbf{P}(\text{not } HHH) = 1 - \mathbf{P}(HHH)$$

$$\mathbf{P}(\text{not } HHH) = 1 - \frac{1}{8}$$

Complement of Probability: Coin Example 1

What is the probability of not landing on heads 3 times?

$$\mathbf{P}(\text{not } HHH) = 1 - \mathbf{P}(HHH)$$

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Complement of Probability: Coin Example 1

What is the probability of not landing on heads 3 times?

$$\mathbf{P}(\text{not } HHH) = 1 - \mathbf{P}(HHH)$$

$$\mathbf{P}(\text{not } HHH) = 1 - \frac{1}{8}$$

$$= \frac{7}{8}$$

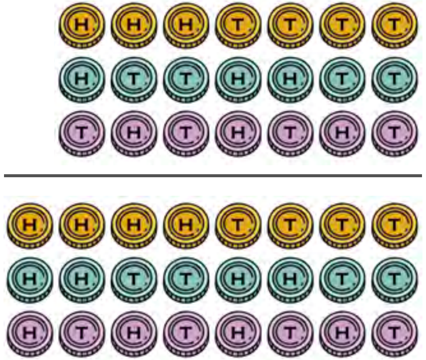
Complement of Probability: Coin Example 1

What is the probability of not landing on heads 3 times?

$$\mathbf{P}(\text{not } HHH) = 1 - \mathbf{P}(HHH)$$

$$\mathbf{P}(\text{not } HHH) = 1 - \frac{1}{8}$$

$$= \frac{7}{8}$$



Complement of Probability: Dice Example 1

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Complement of Probability: Dice Example 1

What is the probability of obtaining anything other than 6?

Complement of Probability: Dice Example 1

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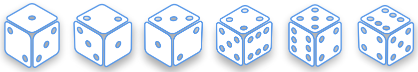

Complement of Probability: Dice Example 1

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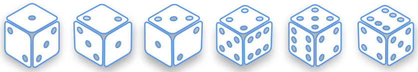
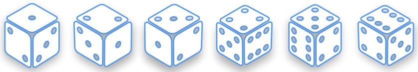


$\mathbf{P}(\text{not } 6) =$

Complement of Probability: Dice Example 1

What is the probability of obtaining anything other than 6?



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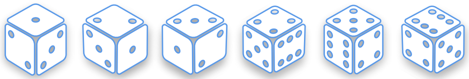

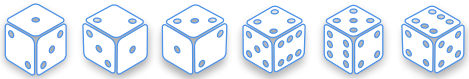

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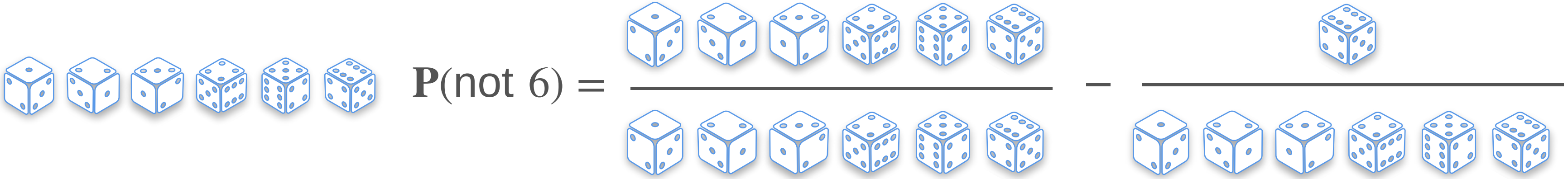

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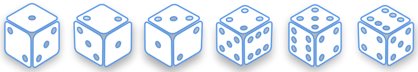
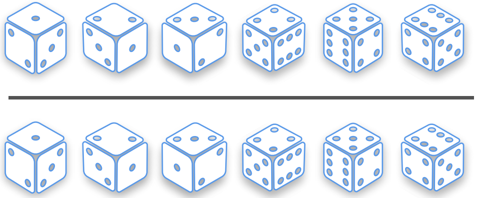
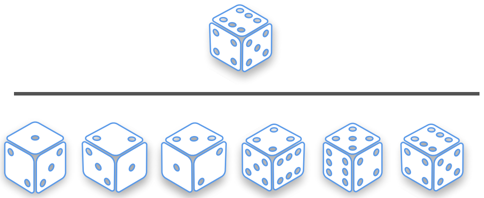


$\mathbf{P}(\text{not } 6) =$  $-$ 

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Complement of Probability: Dice Example 1

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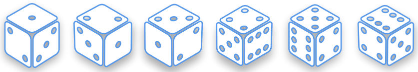

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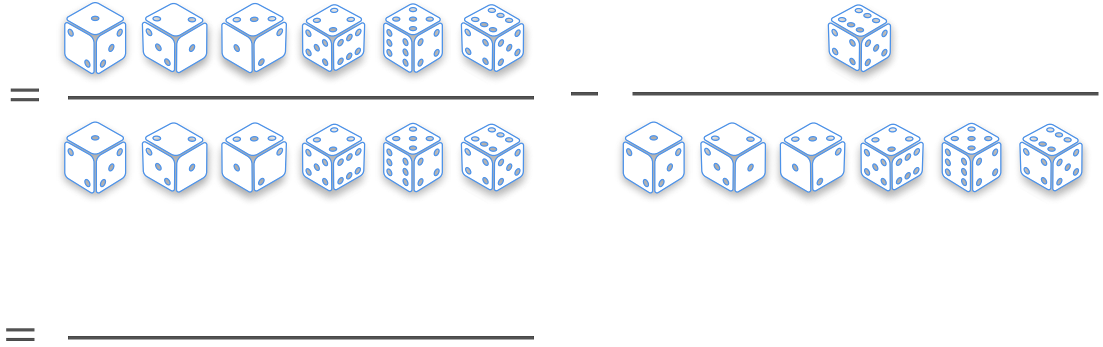

Complement of Probability: Dice Example 1

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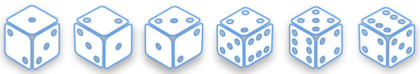

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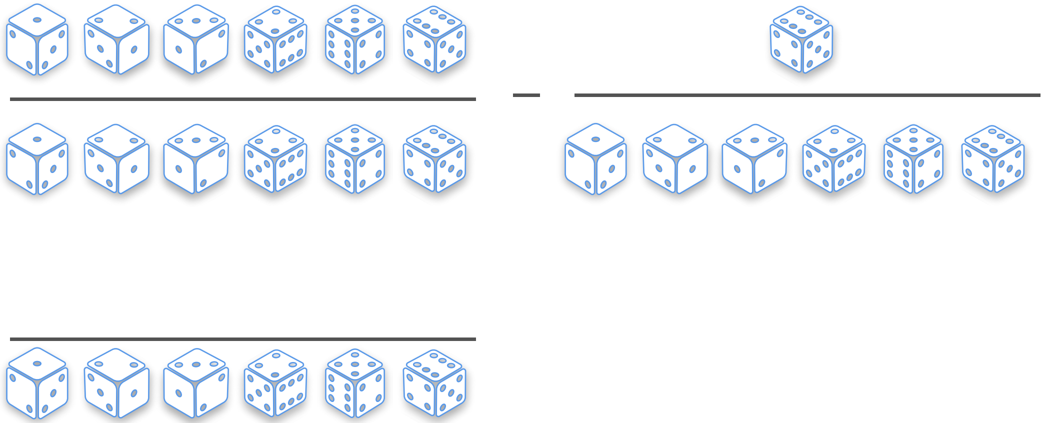

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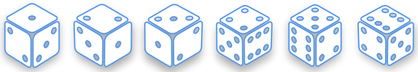

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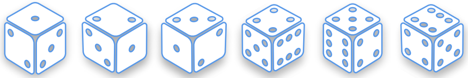

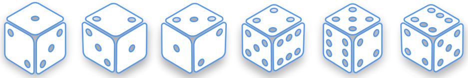

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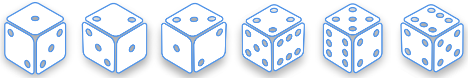

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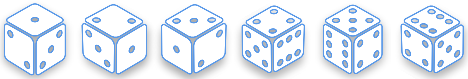

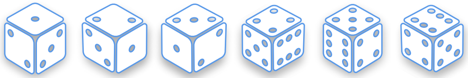

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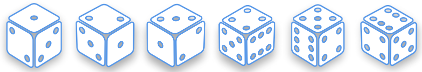

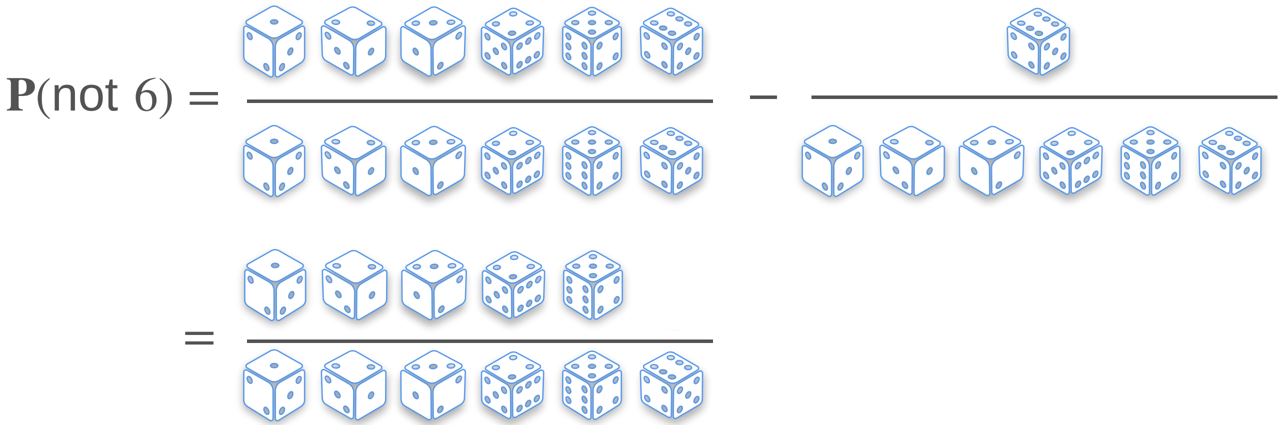

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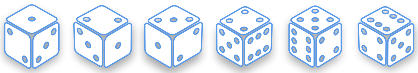

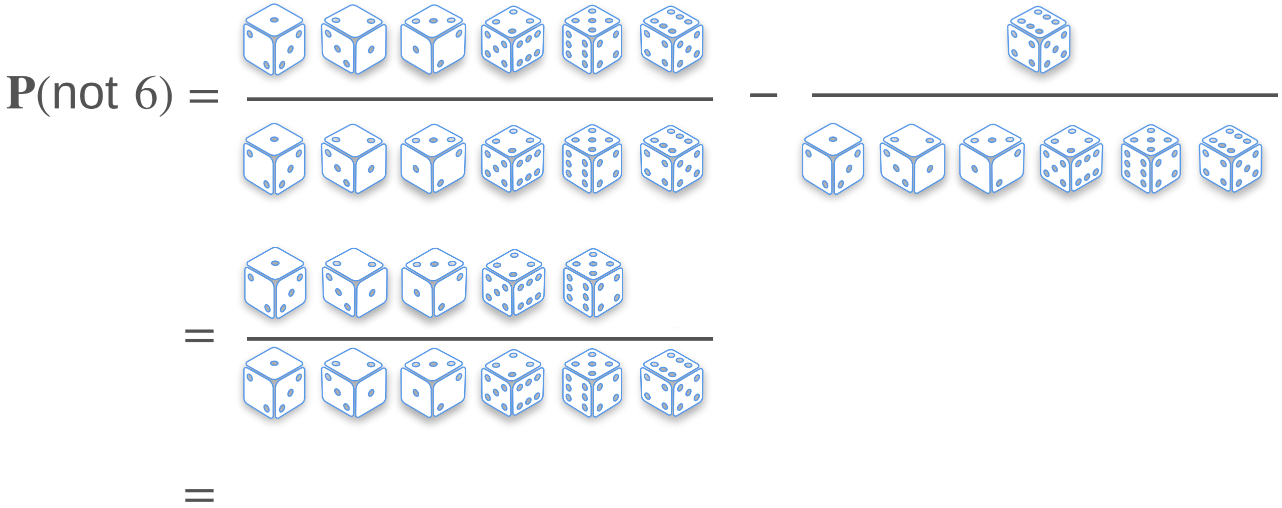

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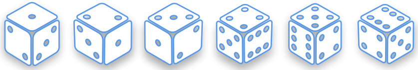
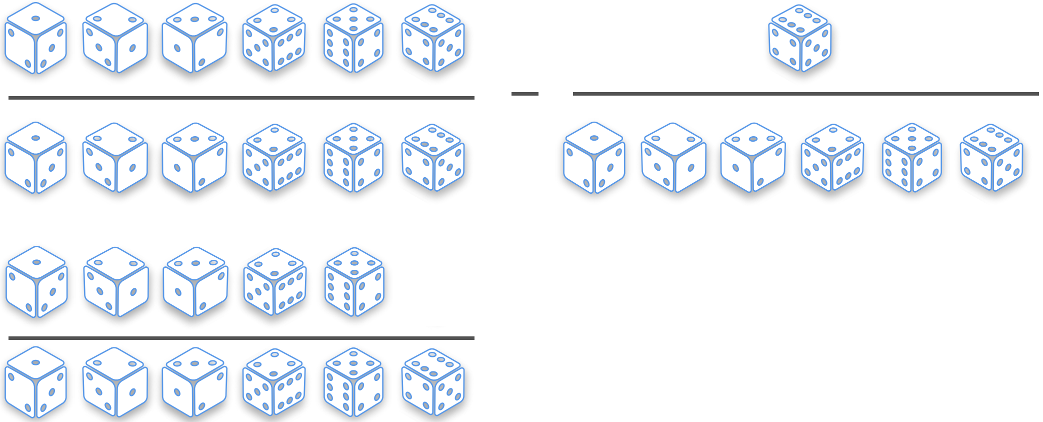


$P(\text{not } 6) =$



$$= \frac{5}{6}$$

DeepLearning.AI

Introduction to probability

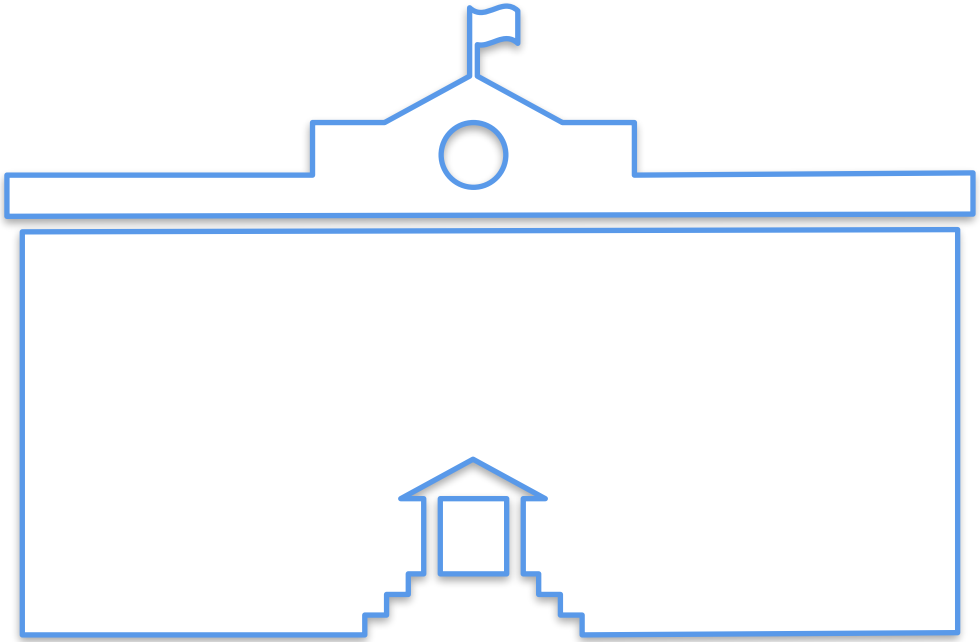
Sum of Probabilities

Sum of Probabilities: Quiz 1

Sum of Probabilities: Quiz 1

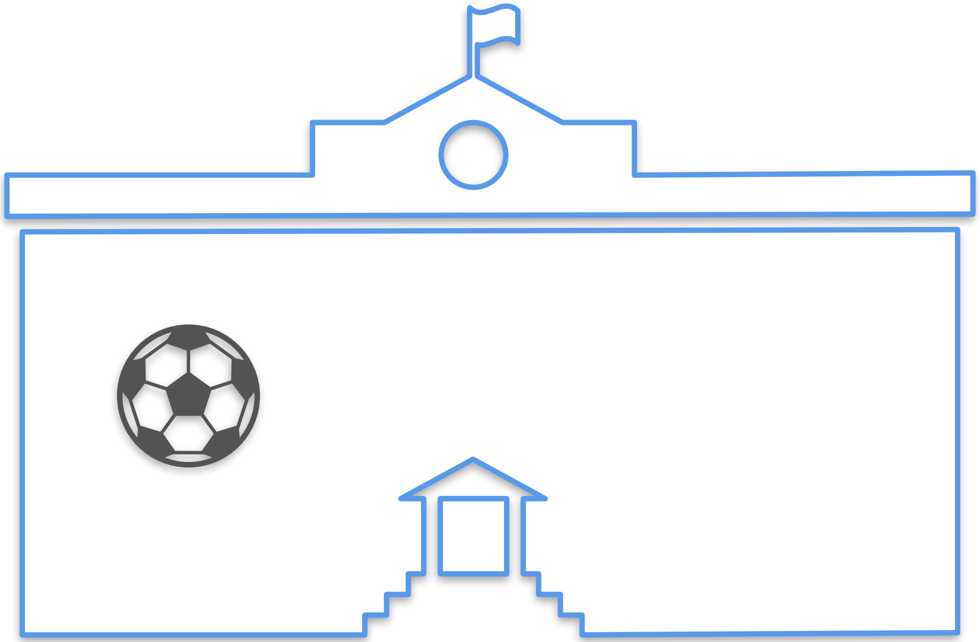
At a school, kids can only play one sport.

Sum of Probabilities: Quiz 1



At a school, kids can only play one sport.

Sum of Probabilities: Quiz 1



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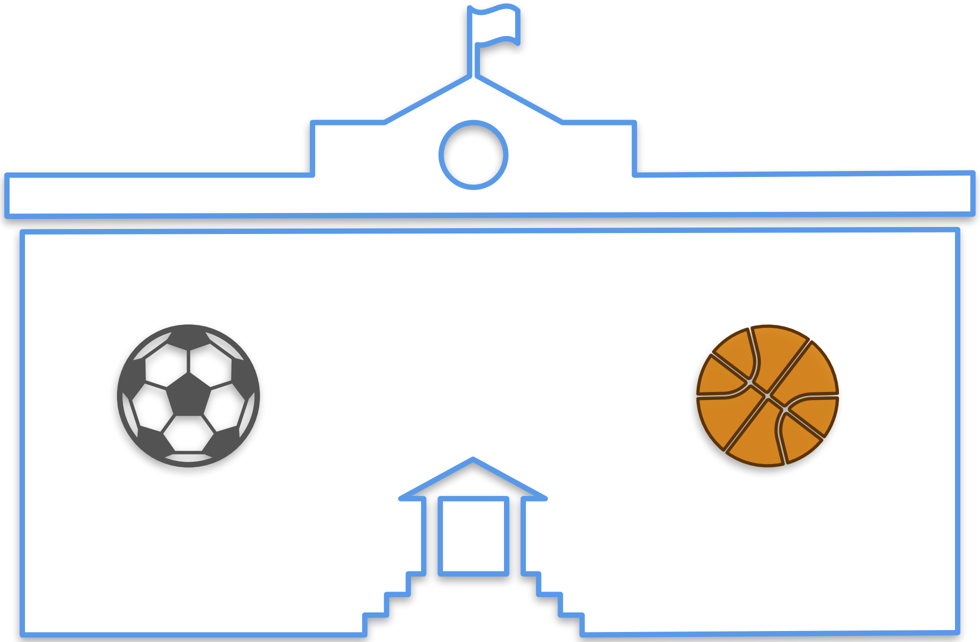

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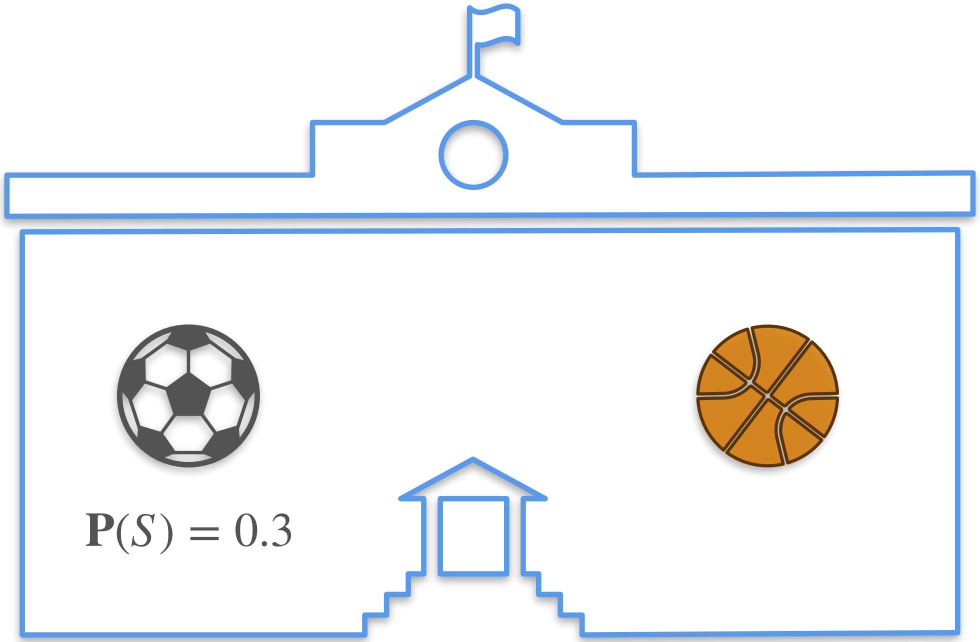

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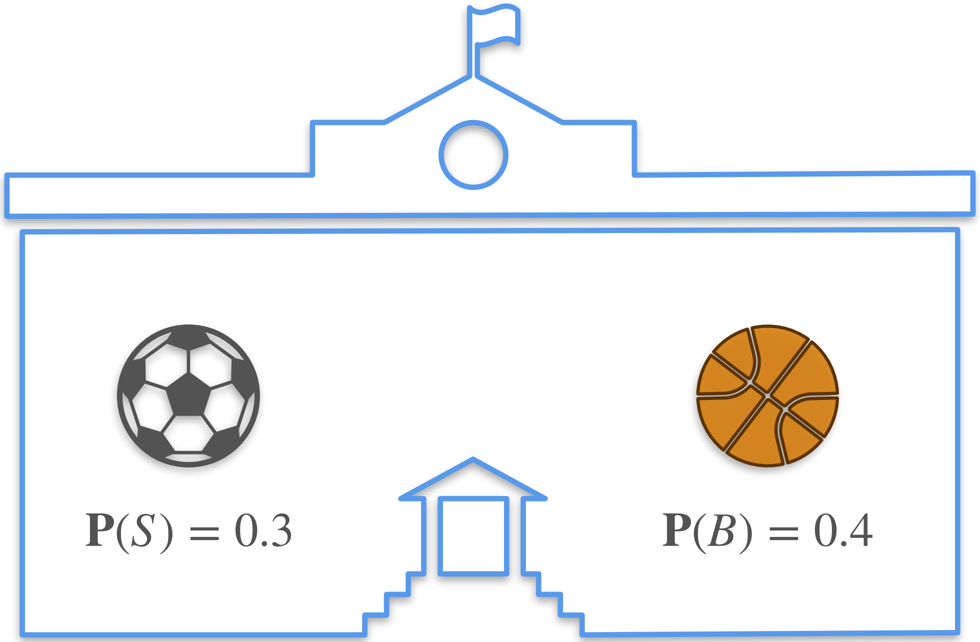

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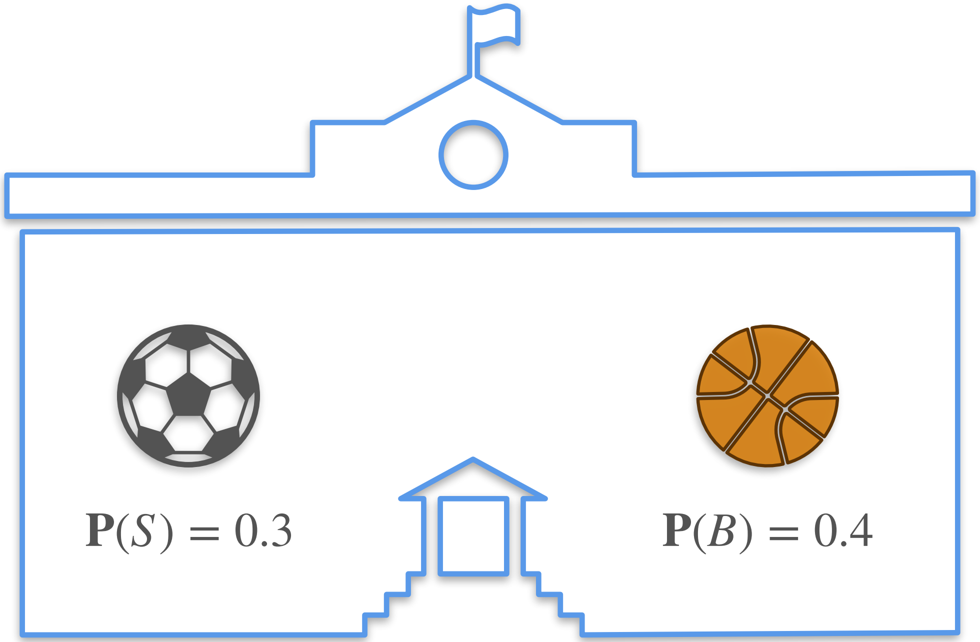
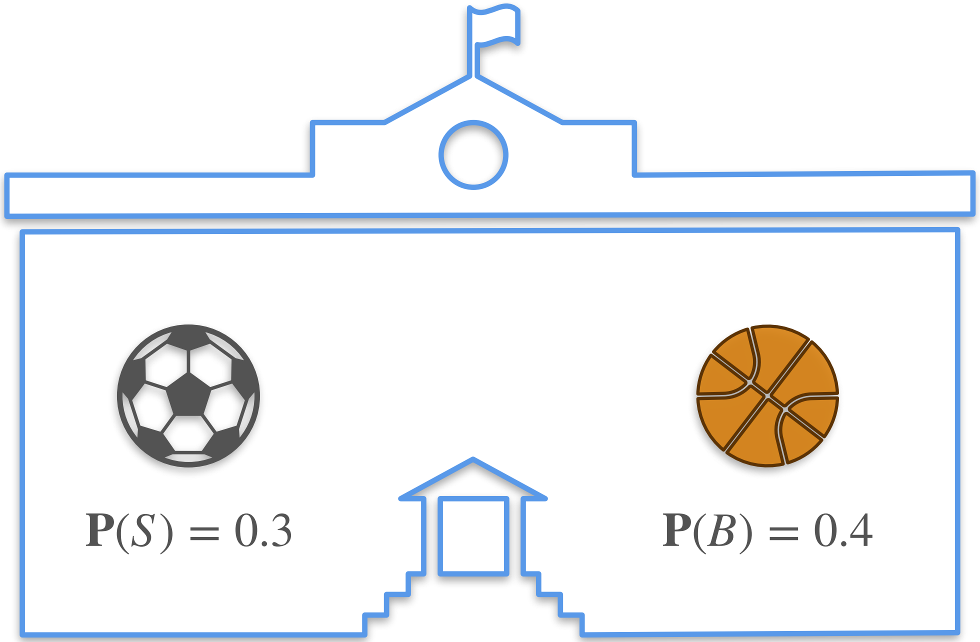


At a school, kids can only play one sport.

What is the probability that a kid plays soccer or basketball?

Sum of Probabilities: Quiz 1



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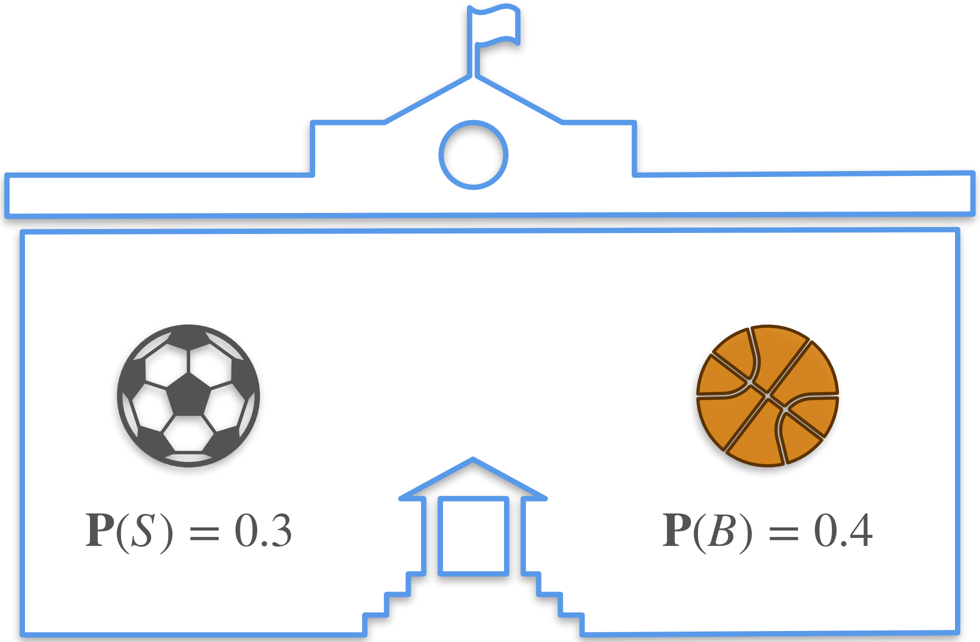

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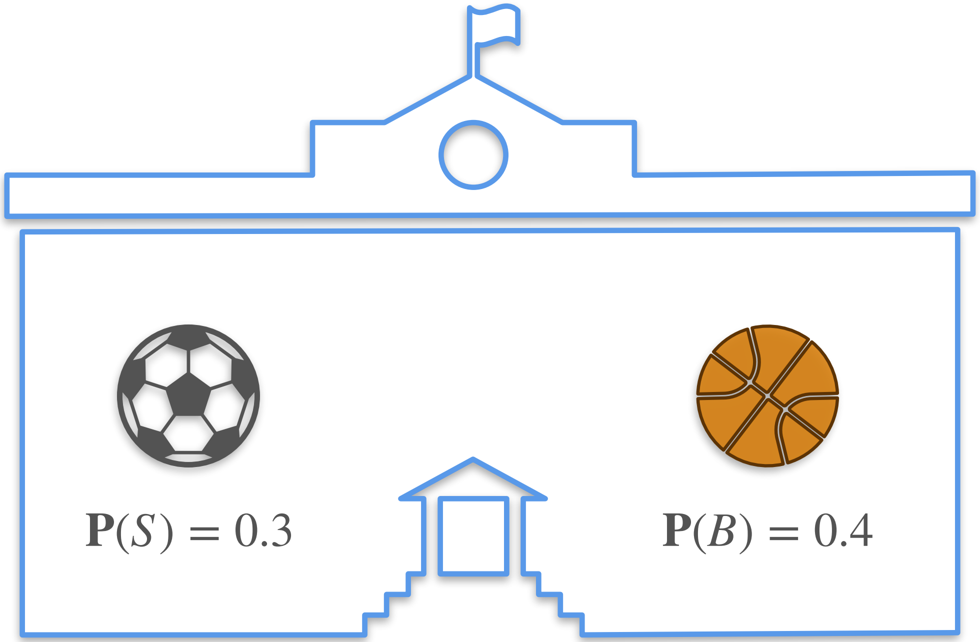


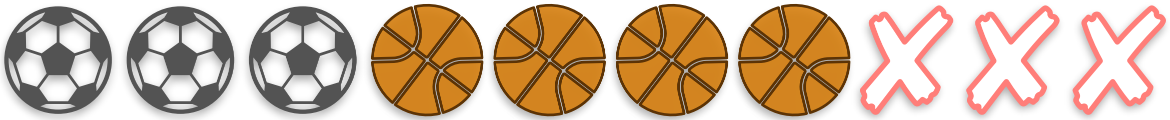
At a school, kids can only play one sport.

What is the probability that a kid plays soccer or basketball?

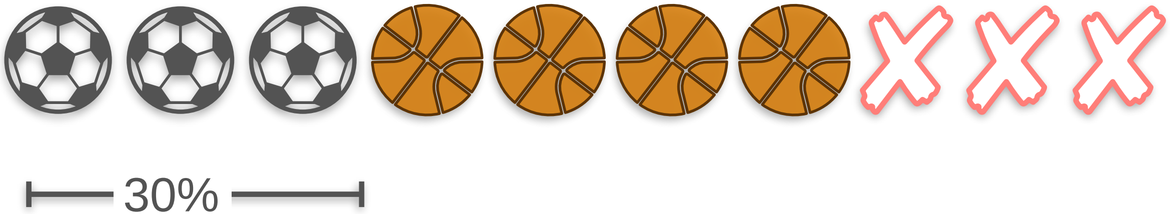
Hint: What if there were only 10 kids?

Sum of Probabilities: Quiz 1 Solution

Sum of Probabilities: Quiz 1 Solution



Sum of Probabilities: Quiz 1 Solution



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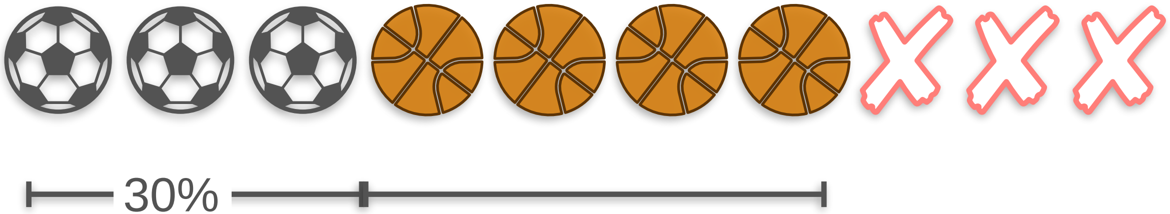
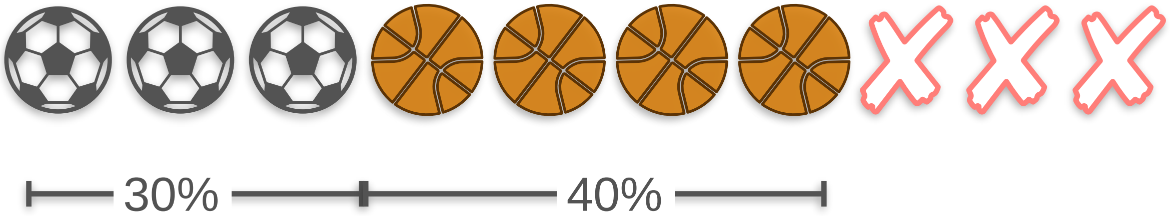


Sum of Probabilities: Quiz 1 Solution



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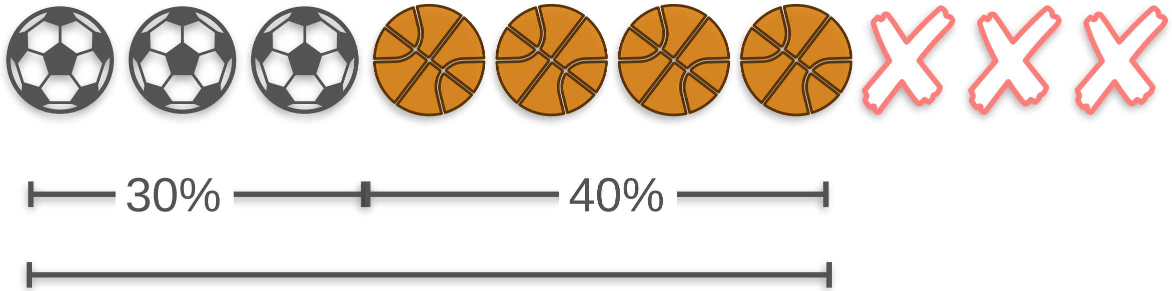

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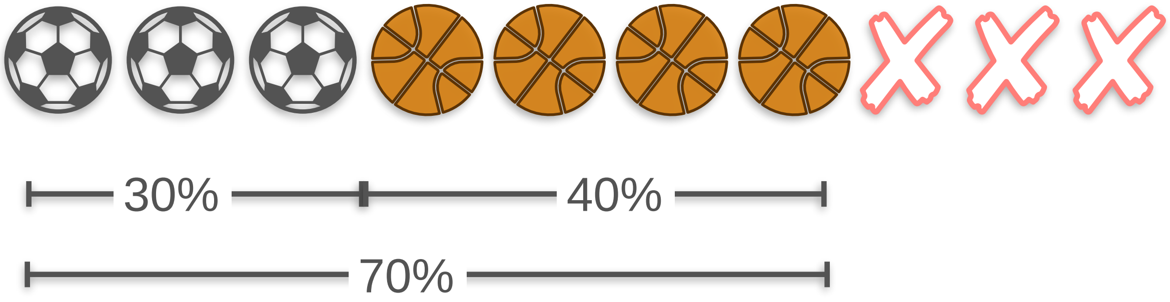

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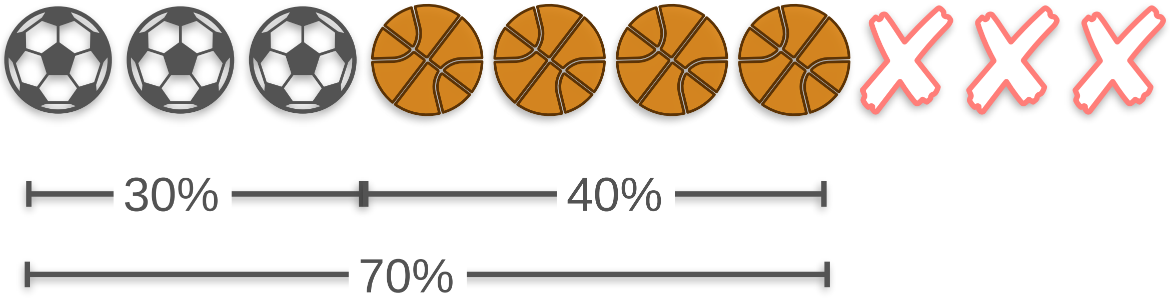
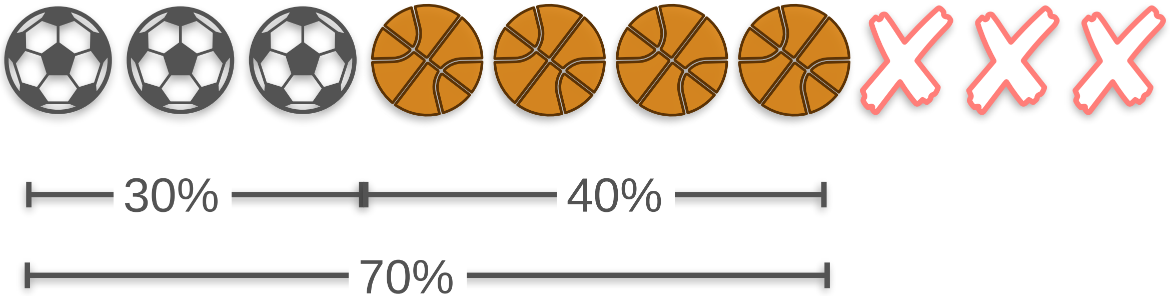


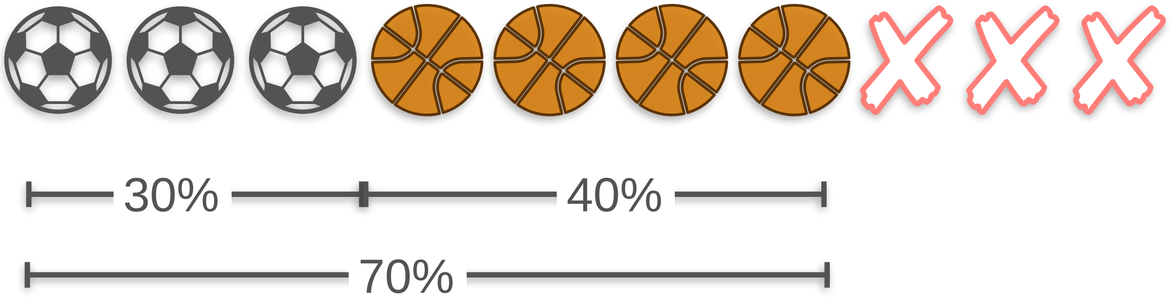
$$\mathbf{P}(\text{soccer or basketball}) = \frac{\text{soccer or basketball}}{\text{total}}$$

Sum of Probabilities: Quiz 1 Solution



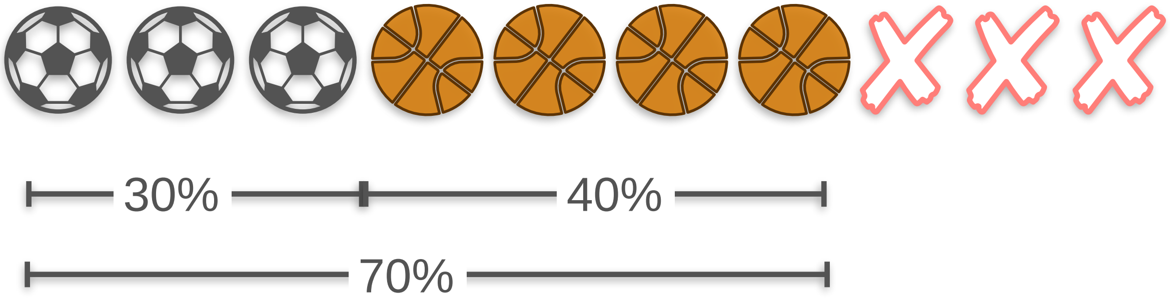
$$\mathbf{P}(\text{soccer or basketball}) = \frac{\text{soccer or basketball}}{\text{total}} = \frac{3+4}{10}$$

Sum of Probabilities: Quiz 1 Solution



$$\mathbf{P}(\text{soccer or basketball}) = \frac{\text{soccer or basketball}}{\text{total}} = \frac{3+4}{10} = 0.7$$

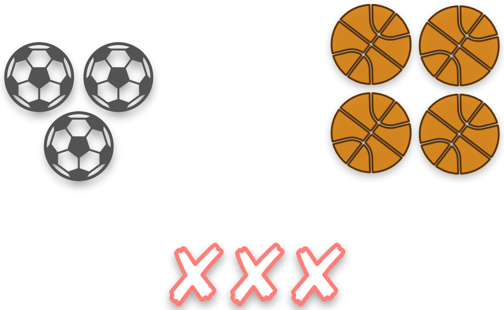
Sum of Probabilities: Quiz 1 Solution



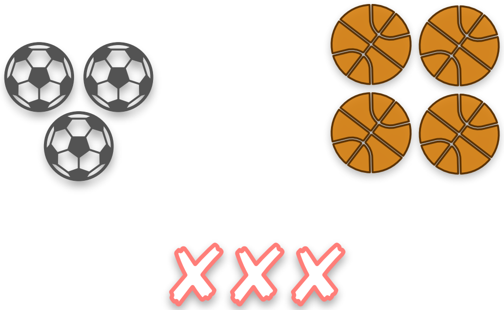
$$\mathbf{P}(\text{soccer or basketball}) = \frac{\text{soccer or basketball}}{\text{total}} = \frac{3+4}{10} = 0.7$$

$$\mathbf{P}(\text{soccer or basketball}) = \mathbf{P}(\text{soccer}) + \mathbf{P}(\text{basketball})$$

Sum of Probabilities: Quiz 1 Solution

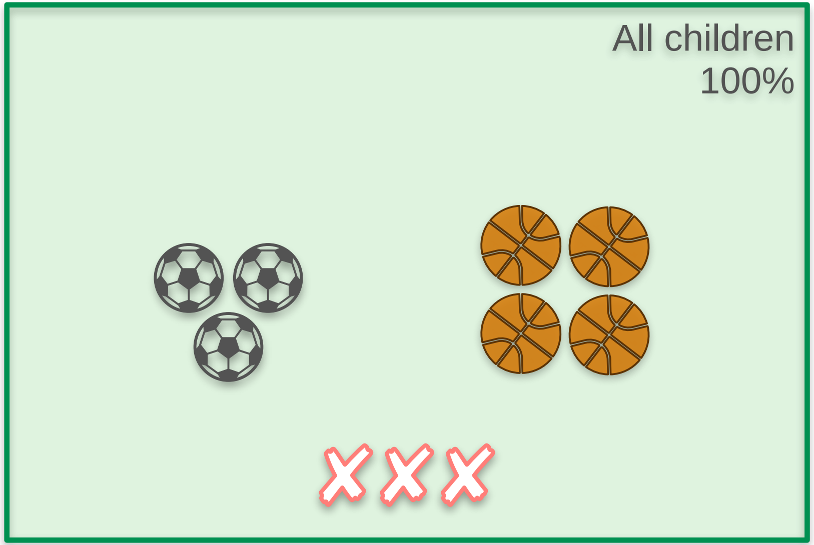


Sum of Probabilities: Quiz 1 Solution



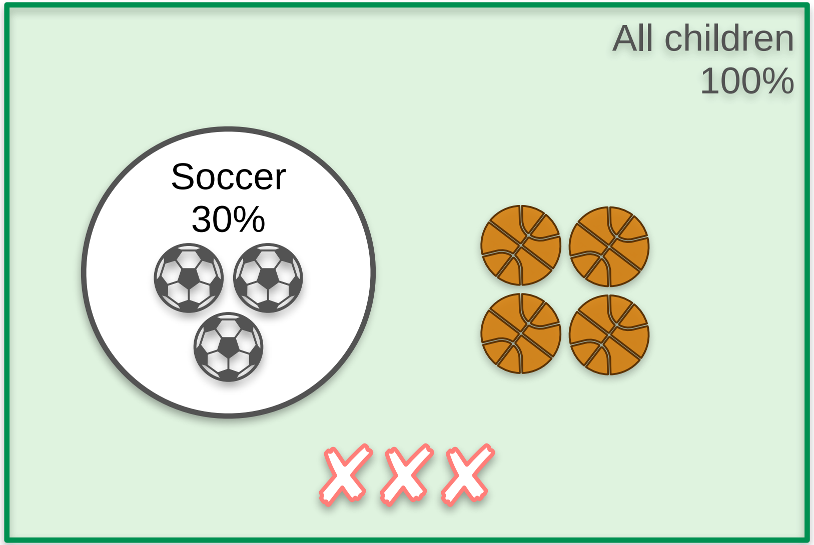
$$\mathbf{P}(\text{soccer} \cup \text{basketball}) = \mathbf{P}(\text{soccer}) + \mathbf{P}(\text{basketball})$$

Sum of Probabilities: Quiz 1 Solution



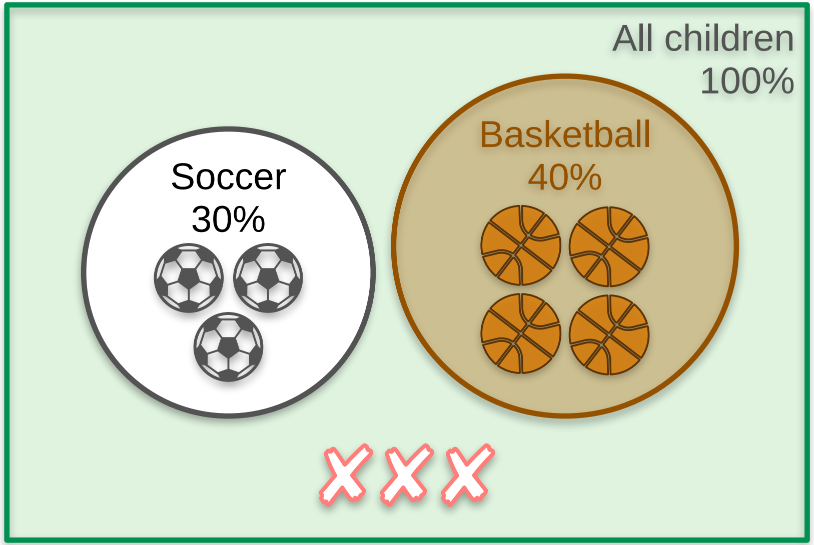
$$\mathbf{P}(\text{soccer} \cup \text{basketball}) = \mathbf{P}(\text{soccer}) + \mathbf{P}(\text{basketball})$$

Sum of Probabilities: Quiz 1 Solution



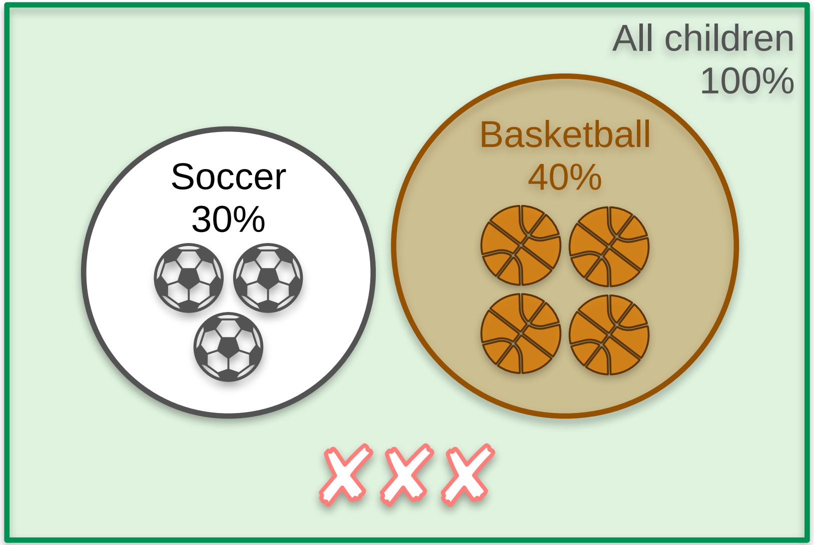
$$\mathbf{P}(\text{soccer} \cup \text{basketball}) = \mathbf{P}(\text{soccer}) + \mathbf{P}(\text{basketball})$$

Sum of Probabilities: Quiz 1 Solution



$$\mathbf{P}(\text{soccer} \cup \text{basketball}) = \mathbf{P}(\text{soccer}) + \mathbf{P}(\text{basketball})$$

Sum of Probabilities: Quiz 1 Solution



$$\mathbf{P}(\text{soccer} \cup \text{basketball}) = \mathbf{P}(\text{soccer}) + \mathbf{P}(\text{basketball})$$

$$\mathbf{P}(A \cup B) = \mathbf{P}(A) + \mathbf{P}(B)$$

Sum of Probabilities: Dice Example 1

Sum of Probabilities: Dice Example 1

Sum of Probabilities: Dice Example 1

What is the probability of obtaining an even number or a 5?

Sum of Probabilities: Dice Example 1

What is the probability of obtaining an even number or a 5?

Sum of Probabilities: Dice Example 1

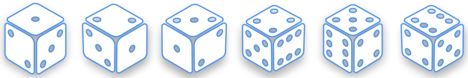
What is the probability of obtaining an even number or a 5?

A

B

Sum of Probabilities: Dice Example 1

What is the probability of obtaining an even number or a 5?

A 

B

Sum of Probabilities: Dice Example 1

What is the probability of obtaining an even number or a 5?

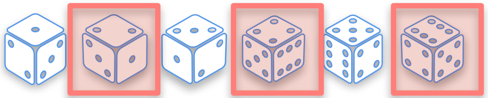
A

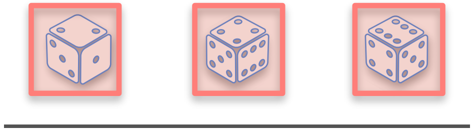
B

Sum of Probabilities: Dice Example 1

What is the probability of obtaining an even number or a 5?

A





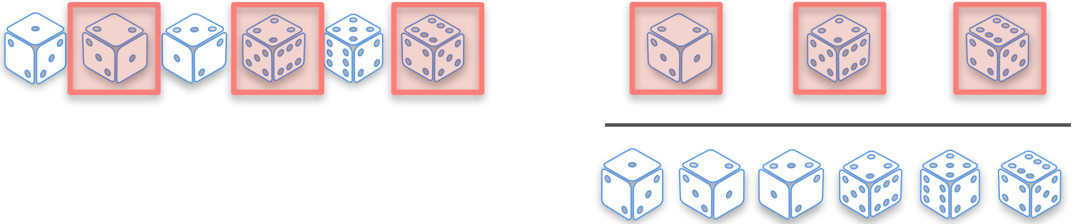
B

Sum of Probabilities: Dice Example 1

What is the probability of obtaining an even number or a 5?

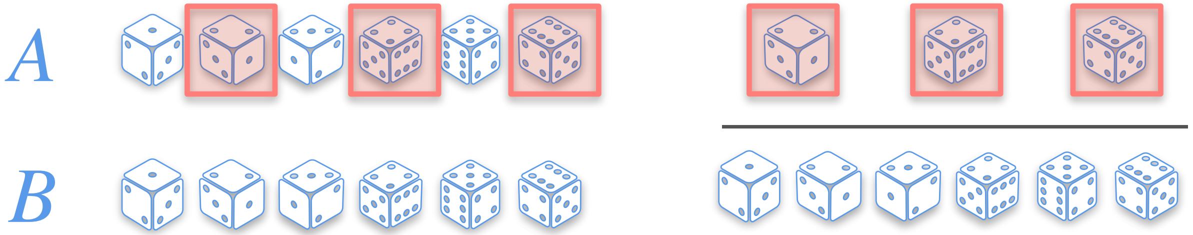
A

B



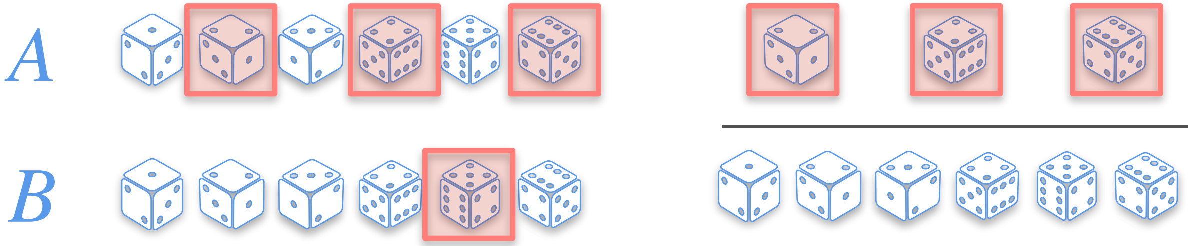
Sum of Probabilities: Dice Example 1

What is the probability of obtaining an even number or a 5?



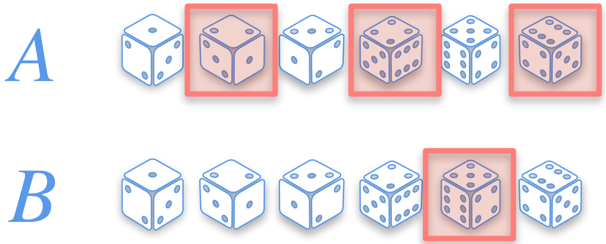
Sum of Probabilities: Dice Example 1

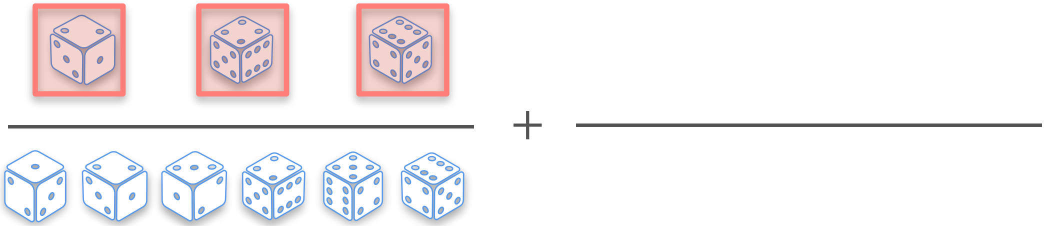
What is the probability of obtaining an even number or a 5?



Sum of Probabilities: Dice Example 1

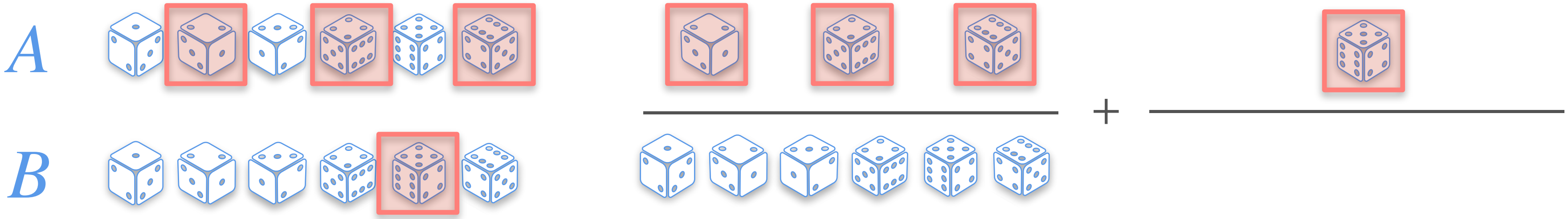
What is the probability of obtaining an even number or a 5?





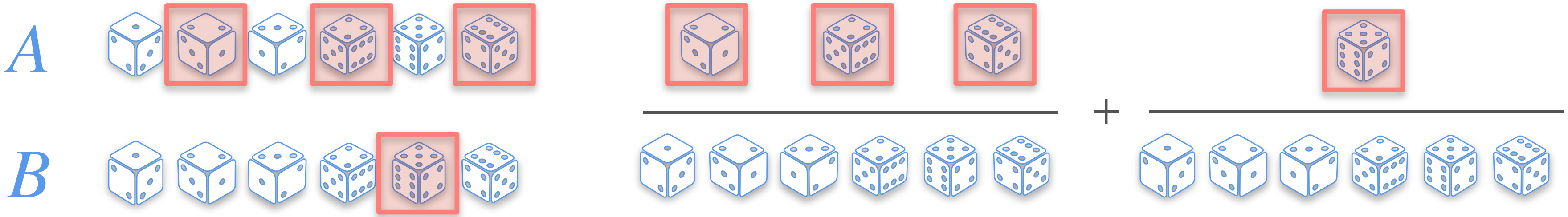
Sum of Probabilities: Dice Example 1

What is the probability of obtaining an even number or a 5?



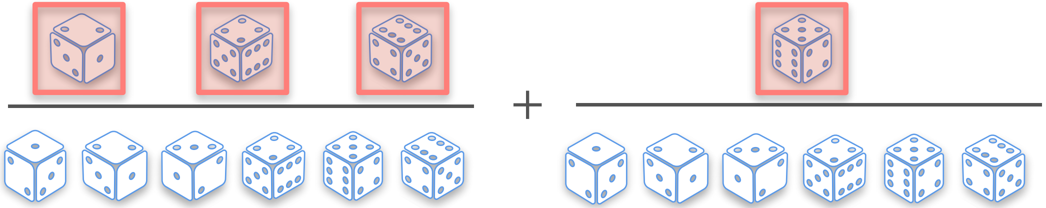
Sum of Probabilities: Dice Example 1

What is the probability of obtaining an even number or a 5?



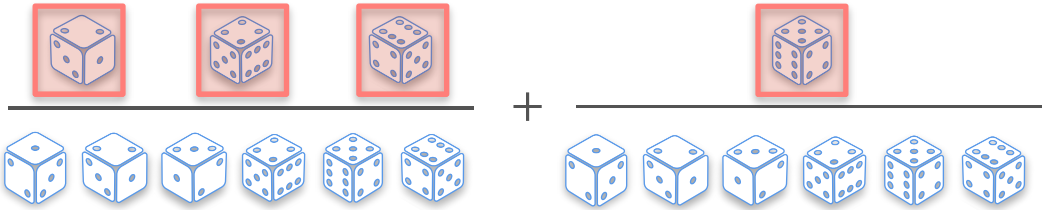
Sum of Probabilities: Dice Example 1

What is the probability of obtaining an even number or a 5?



Sum of Probabilities: Dice Example 1

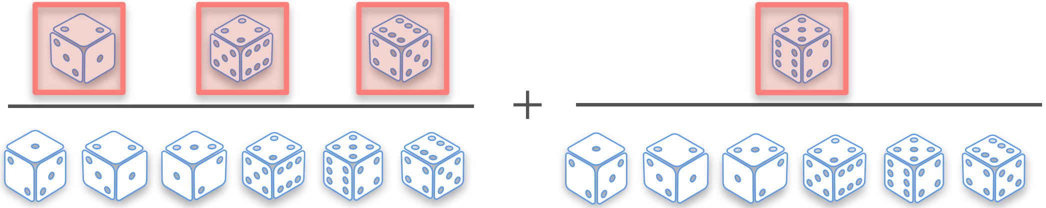
What is the probability of obtaining an even number or a 5?



$\mathbf{P}(\text{even number or 5}) =$

Sum of Probabilities: Dice Example 1

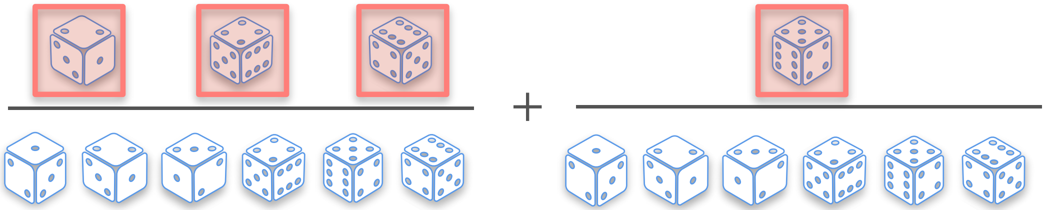
What is the probability of obtaining an even number or a 5?



$$\mathbf{P}(\text{even number or 5}) = \mathbf{P}(\text{even number})$$

Sum of Probabilities: Dice Example 1

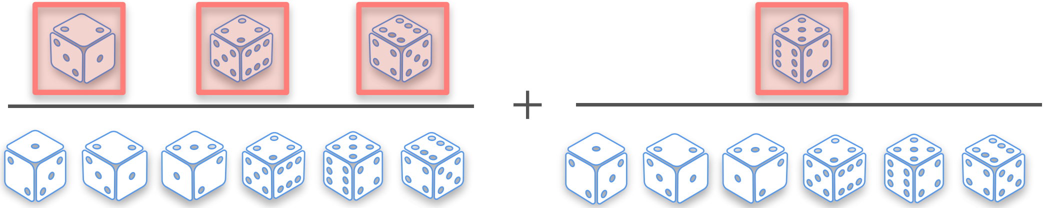
What is the probability of obtaining an even number or a 5?



$$\mathbf{P}(\text{even number or } 5) = \mathbf{P}(\text{even number}) + \mathbf{P}(5)$$

Sum of Probabilities: Dice Example 1

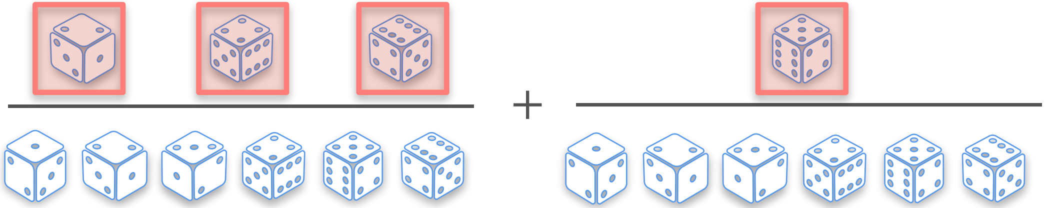
What is the probability of obtaining an even number or a 5?



$$\mathbf{P}(\text{even number or 5}) \;=\; \mathbf{P}(\text{even number}) + \mathbf{P}(5) \;=\; \frac{3}{6}$$

Sum of Probabilities: Dice Example 1

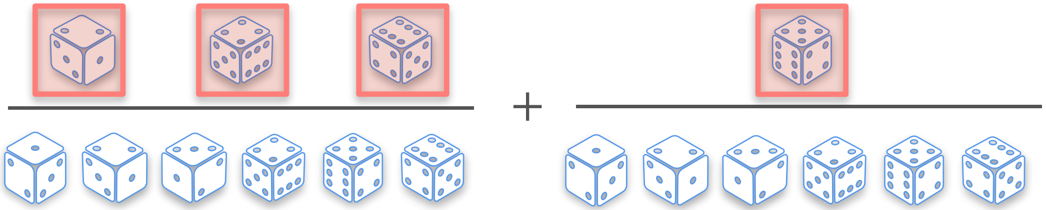
What is the probability of obtaining an even number or a 5?



$$\mathbf{P}(\text{even number or 5}) = \mathbf{P}(\text{even number}) + \mathbf{P}(5) = \frac{3}{6} + \frac{1}{6}$$

Sum of Probabilities: Dice Example 1

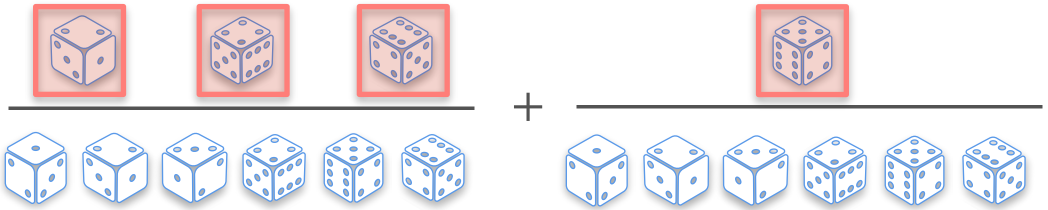
What is the probability of obtaining an even number or a 5?



$$\mathbf{P}(\text{even number or 5}) = \mathbf{P}(\text{even number}) + \mathbf{P}(5) = \frac{3}{6} + \frac{1}{6} = \frac{4}{6}$$

Sum of Probabilities: Dice Example 1

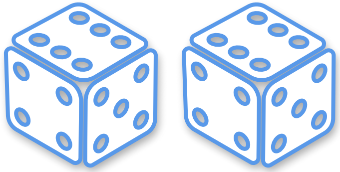
What is the probability of obtaining an even number or a 5?



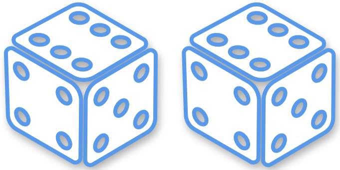
$$\mathbf{P}(\text{even number or 5}) = \mathbf{P}(\text{even number}) + \mathbf{P}(5) = \frac{3}{6} + \frac{1}{6} = \frac{4}{6} = \frac{2}{3}$$

Sum of Probabilities: Dice Example 2

Sum of Probabilities: Dice Example 2



Sum of Probabilities: Dice Example 2



What is the probability of obtaining a sum of 7 or a sum of 10?

Sum of Probabilities: Dice Example 2

Sum of Probabilities: Dice Example 2

A B

Sum of Probabilities: Dice Example 2

A

sum of 7

B

sum of 10

Sum of Probabilities: Dice Example 2

A

sum of 7

B

sum of 10

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

Sum of Probabilities: Dice Example 2

A

sum of 7

B

sum of 10

	⚀	⚁	⚂	⚃	⚄	⚅
⚀	1,1	1,2	1,3	1,4	1,5	1,6
⚁	2,1	2,2	2,3	2,4	2,5	2,6
⚂	3,1	3,2	3,3	3,4	3,5	3,6
⚃	4,1	4,2	4,3	4,4	4,5	4,6
⚄	5,1	5,2	5,3	5,4	5,5	5,6
⚅	6,1	6,2	6,3	6,4	6,5	6,6

Sum of Probabilities: Dice Example 2

A

sum of 7

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

B

sum of 10

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

Sum of Probabilities: Dice Example 2

A or B

sum of 7 or sum of 10

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

Sum of Probabilities: Dice Example 2

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

Sum of Probabilities: Dice Example 2

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$\mathbf{P}$(sum of 7 or sum of 10)

Sum of Probabilities: Dice Example 2

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

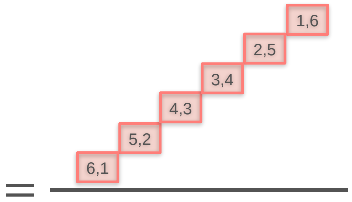
$\mathbf{P}$(sum of 7 or sum of 10)

$$= \frac{\quad}{\quad}$$

Sum of Probabilities: Dice Example 2

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$\mathbf{P}(\text{sum of 7 or sum of 10})$



Sum of Probabilities: Dice Example 2

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

P(sum of 7 or sum of 10)

$=$ numerator: 1,6 · 2,5 · 3,4 · 4,3 · 5,2 · 6,1

denominator:

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

Sum of Probabilities: Dice Example 2

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

P(sum of 7 or sum of 10)

1,6
2,5
3,4
4,3
5,2
6,1

= ――――――――――――― + ―――――――――――――

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

Sum of Probabilities: Dice Example 2

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

P(sum of 7 or sum of 10)

= (1,6 2,5 3,4 4,3 5,2 6,1) / (table below) + (4,6 5,5 6,4) / ( )

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

Sum of Probabilities: Dice Example 2

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

P(sum of 7 or sum of 10)

= (6,1 5,2 4,3 3,4 2,5 1,6) / (table of 36 outcomes) + (6,4 5,5 4,6) / (table of 36 outcomes)

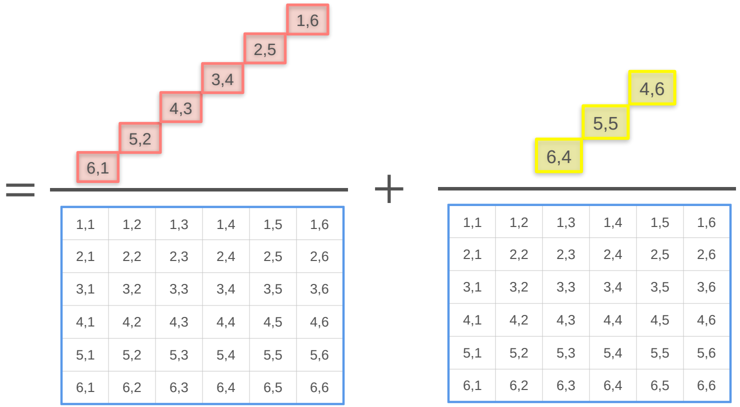
1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

Sum of Probabilities: Dice Example 2

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$\mathbf{P}$(sum of 7 or sum of 10)



$$= \frac{6}{36}$$

Sum of Probabilities: Dice Example 2

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

P(sum of 7 or sum of 10)

$$= \frac{\{6,1\;\; 5,2\;\; 4,3\;\; 3,4\;\; 2,5\;\; 1,6\}}{\text{all 36 outcomes}} + \frac{\{6,4\;\; 5,5\;\; 4,6\}}{\text{all 36 outcomes}}$$

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$$= \frac{6}{36} + \frac{3}{36}$$

Sum of Probabilities: Dice Example 2

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$\mathbf{P}(\text{sum of 7 or sum of 10})$

$$= \frac{6{,}1 \quad 5{,}2 \quad 4{,}3 \quad 3{,}4 \quad 2{,}5 \quad 1{,}6}{\begin{array}{cccccc} 1{,}1 & 1{,}2 & 1{,}3 & 1{,}4 & 1{,}5 & 1{,}6 \\ 2{,}1 & 2{,}2 & 2{,}3 & 2{,}4 & 2{,}5 & 2{,}6 \\ 3{,}1 & 3{,}2 & 3{,}3 & 3{,}4 & 3{,}5 & 3{,}6 \\ 4{,}1 & 4{,}2 & 4{,}3 & 4{,}4 & 4{,}5 & 4{,}6 \\ 5{,}1 & 5{,}2 & 5{,}3 & 5{,}4 & 5{,}5 & 5{,}6 \\ 6{,}1 & 6{,}2 & 6{,}3 & 6{,}4 & 6{,}5 & 6{,}6 \end{array}} + \frac{6{,}4 \quad 5{,}5 \quad 4{,}6}{\begin{array}{cccccc} 1{,}1 & 1{,}2 & 1{,}3 & 1{,}4 & 1{,}5 & 1{,}6 \\ 2{,}1 & 2{,}2 & 2{,}3 & 2{,}4 & 2{,}5 & 2{,}6 \\ 3{,}1 & 3{,}2 & 3{,}3 & 3{,}4 & 3{,}5 & 3{,}6 \\ 4{,}1 & 4{,}2 & 4{,}3 & 4{,}4 & 4{,}5 & 4{,}6 \\ 5{,}1 & 5{,}2 & 5{,}3 & 5{,}4 & 5{,}5 & 5{,}6 \\ 6{,}1 & 6{,}2 & 6{,}3 & 6{,}4 & 6{,}5 & 6{,}6 \end{array}}$$

$$= \frac{6}{36} + \frac{3}{36}$$

$$= \frac{9}{36}$$

Sum of Probabilities: Dice Example 2

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

P(sum of 7 or sum of 10)

1,6 2,5 3,4 4,3 5,2 6,1

=

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

4,6 5,5 6,4

\+

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$$= \frac{6}{36} + \frac{3}{36}$$

$$= \frac{9}{36} = \frac{1}{4}$$

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Sum of Probabilities: Dice Example 2

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$\mathbf{P}(\text{sum of 7 or sum of 10})$

1,6 2,5 3,4 4,3

$= \boxed{\mathbf{P}(\text{sum of 7})}$

2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$+$

4,6 5,5 6,4

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$$= \frac{6}{36} + \frac{3}{36}$$

$$= \frac{9}{36} = \frac{1}{4}$$

Sum of Probabilities: Dice Example 2

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$\mathbf{P}$(sum of 7 or sum of 10)

1,6 2,5 3,4 4,3

4,6 5,5

$= \boxed{\mathbf{P}(\text{sum of 7})} + \boxed{\mathbf{P}(\text{sum of 10})}$

2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

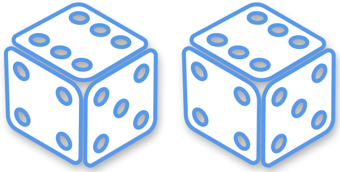
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$$= \frac{6}{36} + \frac{3}{36}$$

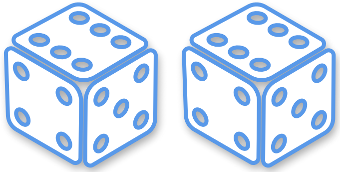
$$= \frac{9}{36} = \frac{1}{4}$$

Sum of Probabilities: Dice Example 3

Sum of Probabilities: Dice Example 3



Sum of Probabilities: Dice Example 3



What is the probability of obtaining
a difference of 2 or a difference of 1?

Sum of Probabilities: Dice Example 3

Sum of Probabilities: Dice Example 3

A

diff = 2

B

diff = 1

Sum of Probabilities: Dice Example 3

A

diff = 2

B

diff = 1

	⚀	⚁	⚂	⚃	⚄	⚅
⚀	1,1	1,2	1,3	1,4	1,5	1,6
⚁	2,1	2,2	2,3	2,4	2,5	2,6
⚂	3,1	3,2	3,3	3,4	3,5	3,6
⚃	4,1	4,2	4,3	4,4	4,5	4,6
⚄	5,1	5,2	5,3	5,4	5,5	5,6
⚅	6,1	6,2	6,3	6,4	6,5	6,6

Sum of Probabilities: Dice Example 3

A

diff = 2

B

diff = 1

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

Sum of Probabilities: Dice Example 3

A

diff = 2

1,1	1,2	**1,3**	1,4	1,5	1,6
2,1	2,2	2,3	**2,4**	2,5	2,6
3,1	3,2	3,3	3,4	**3,5**	3,6
4,1	**4,2**	4,3	4,4	4,5	**4,6**
5,1	5,2	**5,3**	5,4	5,5	5,6
6,1	6,2	6,3	**6,4**	6,5	6,6

B

diff = 1

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

Sum of Probabilities: Dice Example 3

A

diff = 2

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

B

diff = 1

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

Sum of Probabilities: Dice Example 3

A

diff = 2

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

B

diff = 1

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

Sum of Probabilities: Dice Example 3

A or B

diff = 2 or diff = 1

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

Sum of Probabilities: Dice Example 3

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

Sum of Probabilities: Dice Example 3

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$\mathbf{P}(\text{diff} = 2 \text{ or diff} = 1)$

Sum of Probabilities: Dice Example 3

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$\mathbf{P}(\text{diff} = 2 \text{ or diff} = 1)$

$= \underline{\hspace{6cm}}$

Sum of Probabilities: Dice Example 3

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

P(diff = 2 or diff = 1)

1,3 2,4 3,5 4,6

3,1 4,2 5,3 6,4

= ―――――

Sum of Probabilities: Dice Example 3

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

P(diff = 2 or diff = 1)

Numerator:

1,3 2,4 3,5 4,6 3,1 4,2 5,3 6,4

= (the outcomes above) divided by:

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

Sum of Probabilities: Dice Example 3

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$\mathbf{P}(\text{diff} = 2 \text{ or diff} = 1)$

1,3 2,4 3,5 4,6

3,1 4,2 5,3 6,4

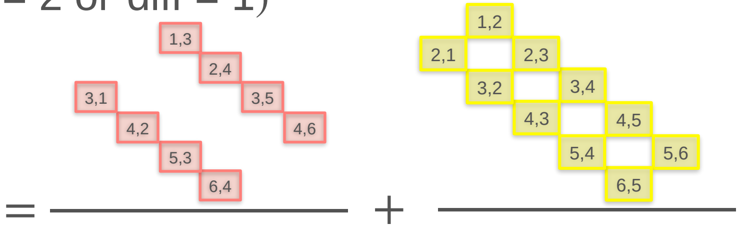
$=$ ―――――― $+$ ――――――

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

Sum of Probabilities: Dice Example 3

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

P(diff = 2 or diff = 1)

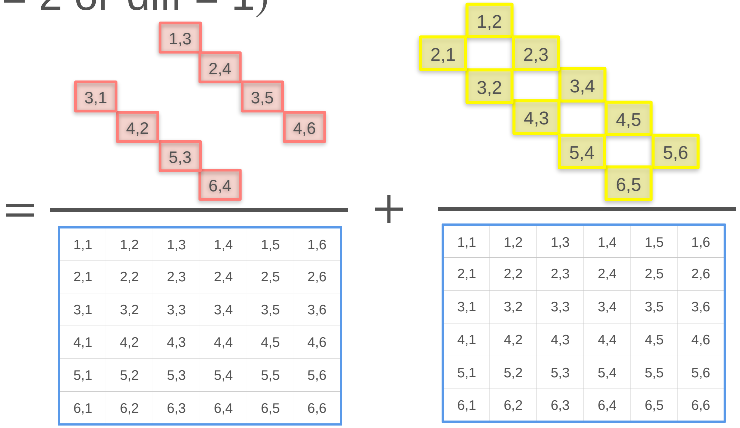


1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

Sum of Probabilities: Dice Example 3

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

P(diff = 2 or diff = 1)



Sum of Probabilities: Dice Example 3

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$\mathbf{P}(\text{diff} = 2 \text{ or diff} = 1)$

= (1,3 2,4 3,5 4,6 3,1 4,2 5,3 6,4) /

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

\+ (1,2 2,1 2,3 3,2 3,4 4,3 4,5 5,4 5,6 6,5) /

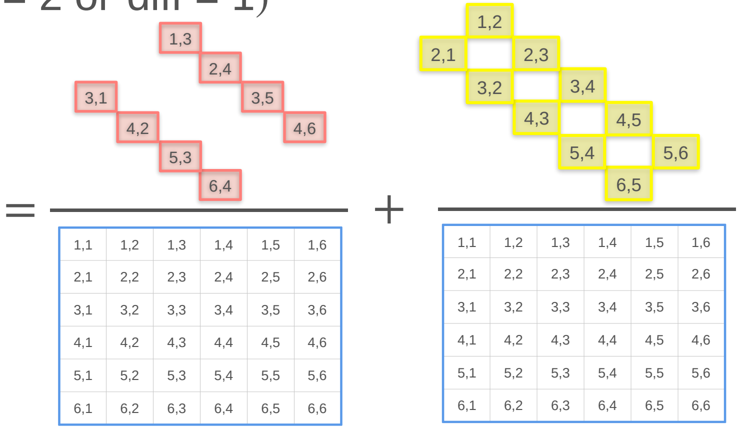
1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$$= \frac{8}{36}$$

Sum of Probabilities: Dice Example 3

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$\mathbf{P}(\text{diff} = 2 \text{ or diff} = 1)$



$$= \frac{8}{36} + \frac{10}{36}$$

Sum of Probabilities: Dice Example 3

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

P(diff = 2 or diff = 1)

Numerator (diff = 2): 1,3 · 2,4 · 3,5 · 4,6 · 3,1 · 4,2 · 5,3 · 6,4

Numerator (diff = 1): 1,2 · 2,1 · 2,3 · 3,2 · 3,4 · 4,3 · 4,5 · 5,4 · 5,6 · 6,5

Denominator (each term):

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$$= \frac{8}{36} + \frac{10}{36}$$

$$= \frac{18}{36}$$

Sum of Probabilities: Dice Example 3

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$\mathbf{P}(\text{diff} = 2 \text{ or diff} = 1)$

1,3 2,4 3,5 4,6 3,1 4,2 5,3

$$= \boxed{\mathbf{P}(\text{diff} = 2)}$$

2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$+$

1,2 2,1 2,3 3,2 3,4 4,3 4,5 5,4 5,6 6,5

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$$= \frac{8}{36} + \frac{10}{36}$$

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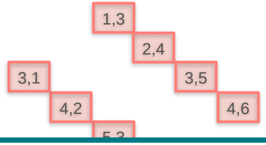
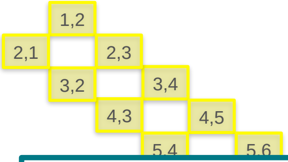
Sum of Probabilities: Dice Example 3

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$\mathbf{P}(\text{diff} = 2 \text{ or diff} = 1)$





$$= \mathbf{P}(\text{diff} = 2) + \mathbf{P}(\text{diff} = 1)$$

2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$$= \frac{8}{36} + \frac{10}{36}$$

$$= \frac{18}{36}$$

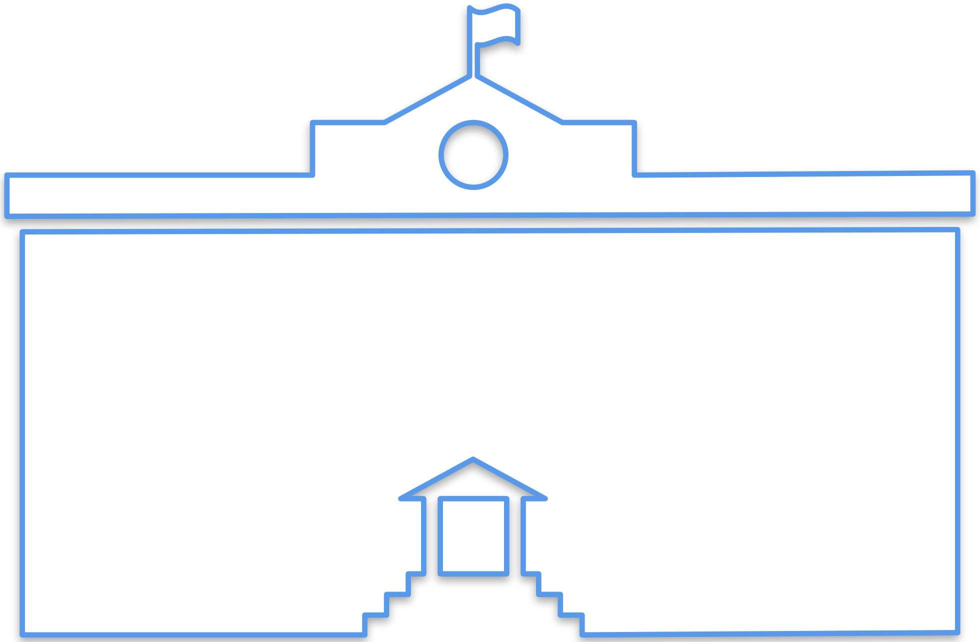
Introduction to probability

Sum of Probabilities (Joint Events)

Sum of Probabilities (Joint Events): Quiz 1

At a school, kids can play as many sports as they want.

Sum of Probabilities (Joint Events): Quiz 1



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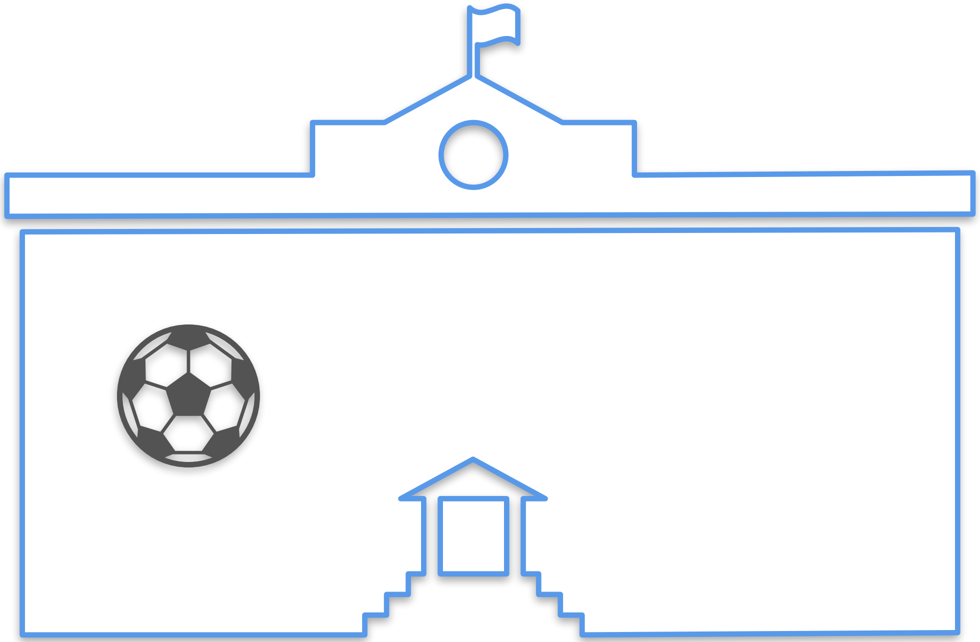
Sum of Probabilities (Joint Events): Quiz 1



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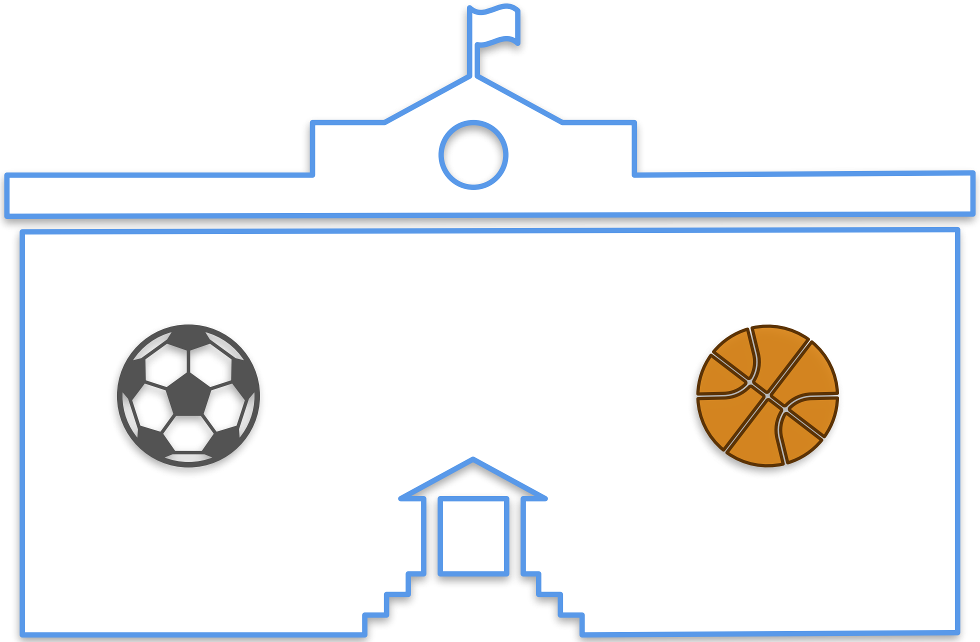

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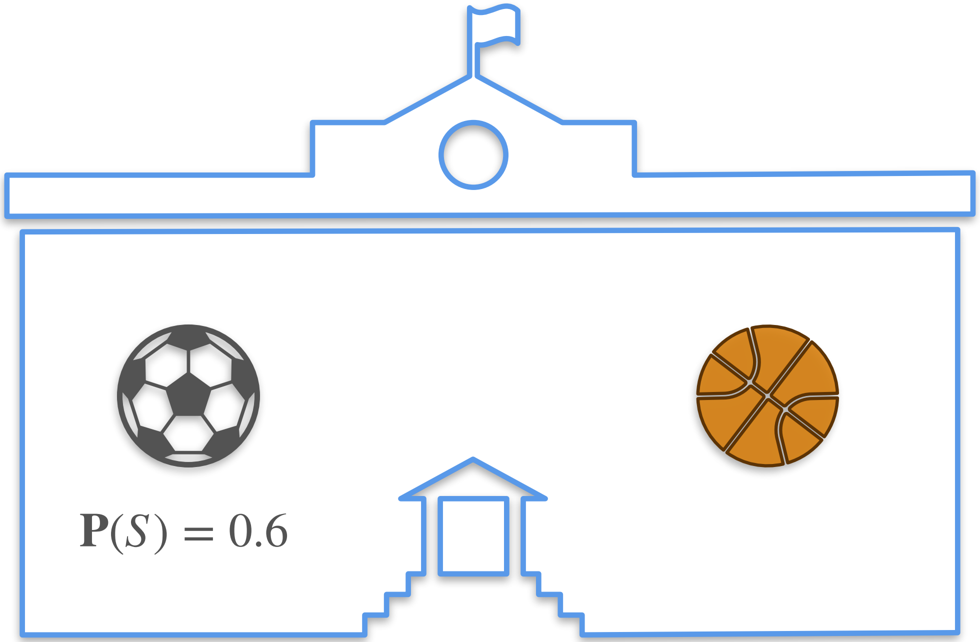

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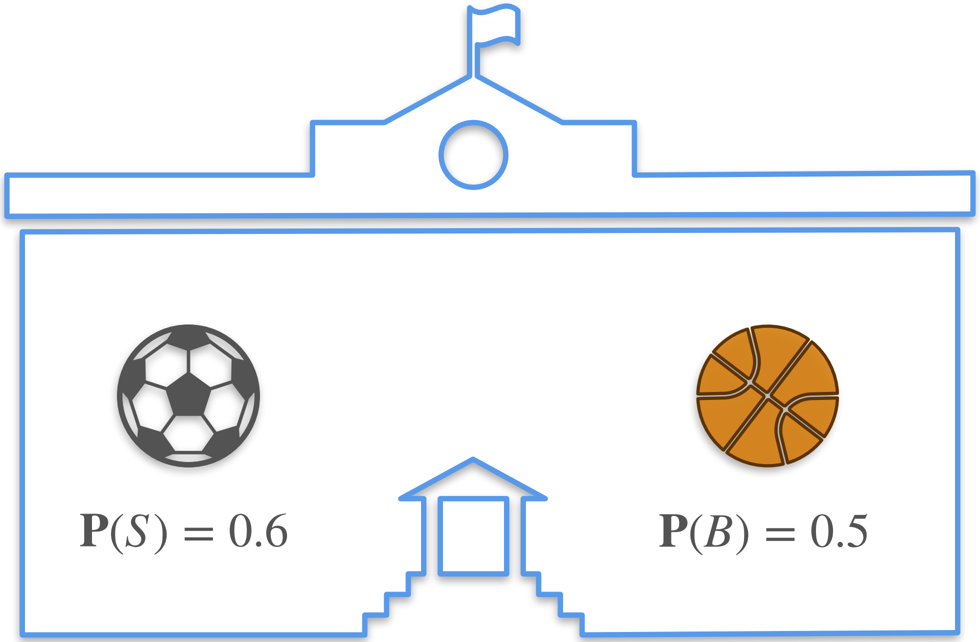

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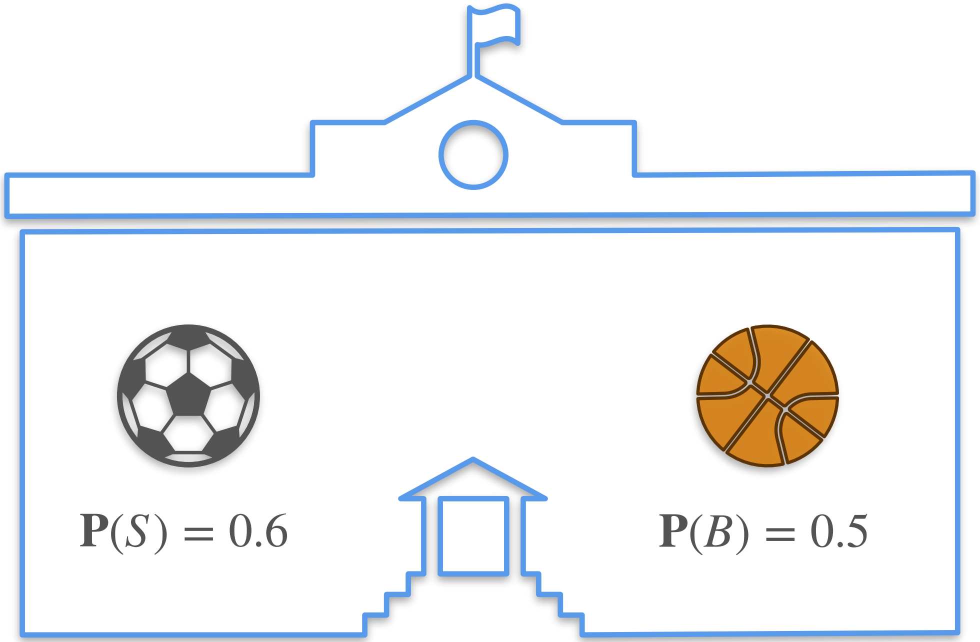
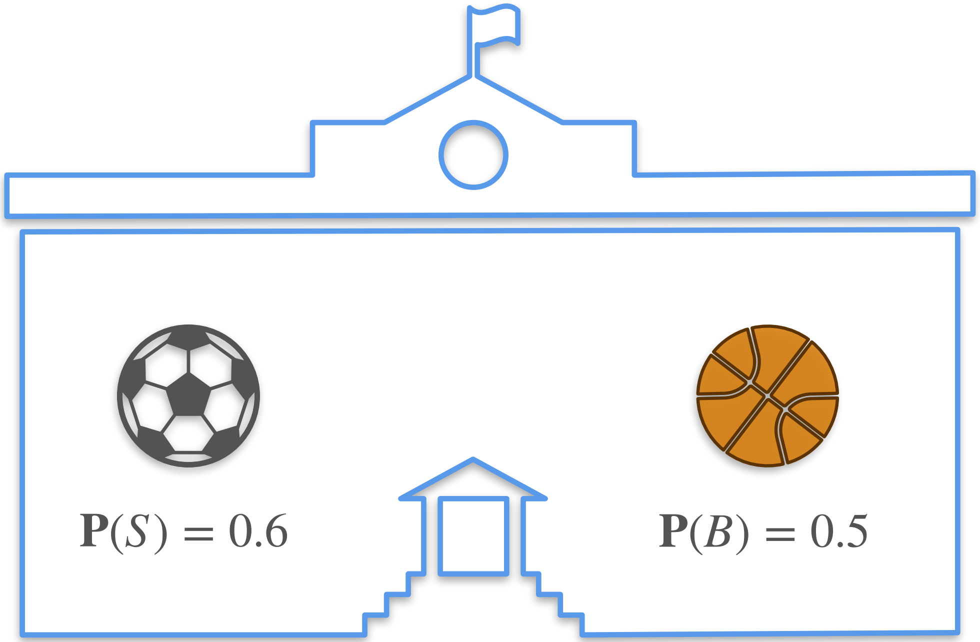


At a school, kids can play as many sports as they want.

What is the probability that a kid plays soccer or basketball?

Sum of Probabilities (Joint Events): Quiz 1



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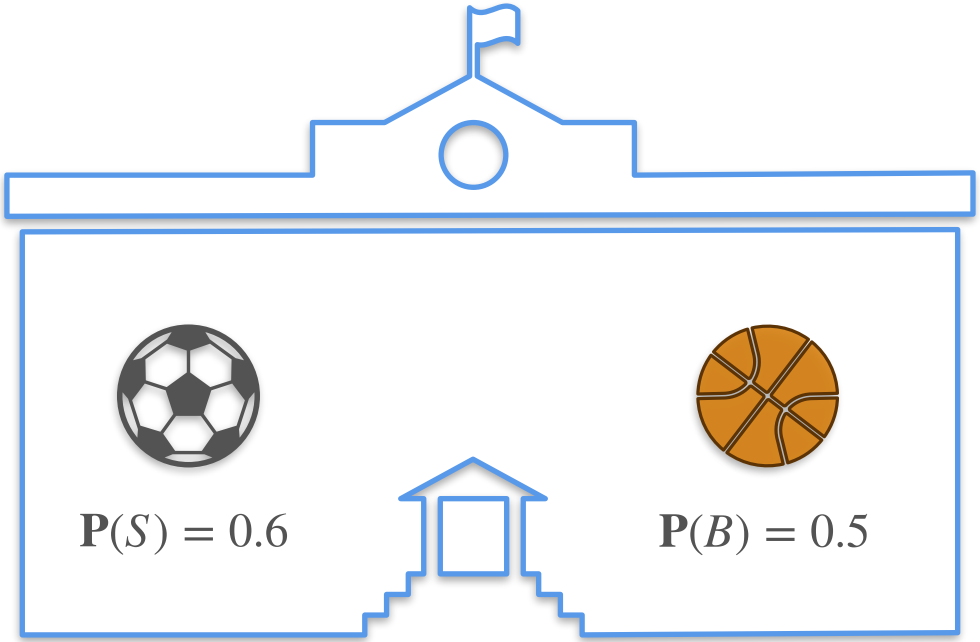

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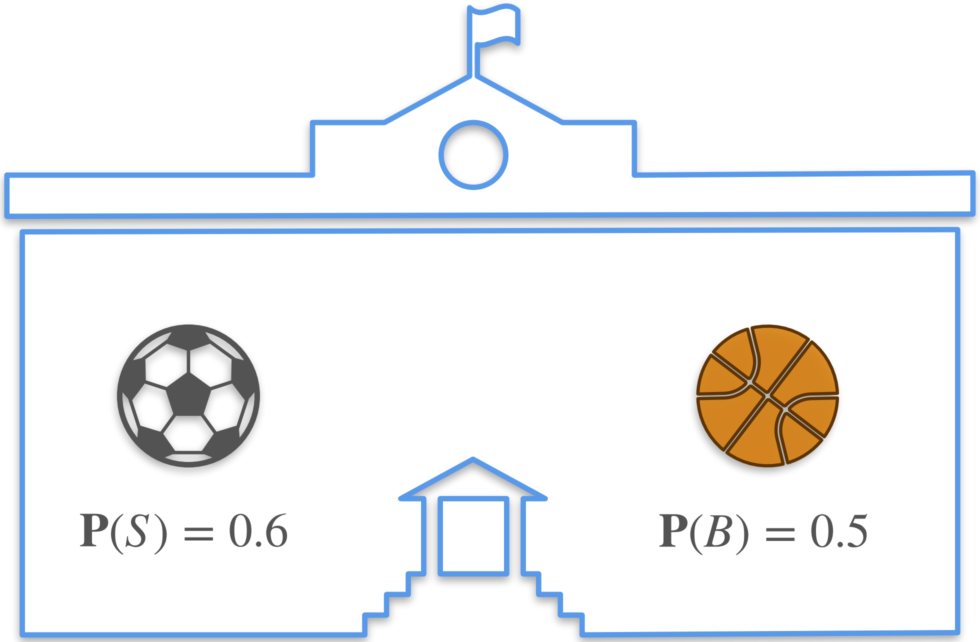

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What is the probability that a kid plays soccer or basketball?

Hint: What if there were only 10 kids?

Sum of Probabilities (Joint Events): Quiz 1 Solution

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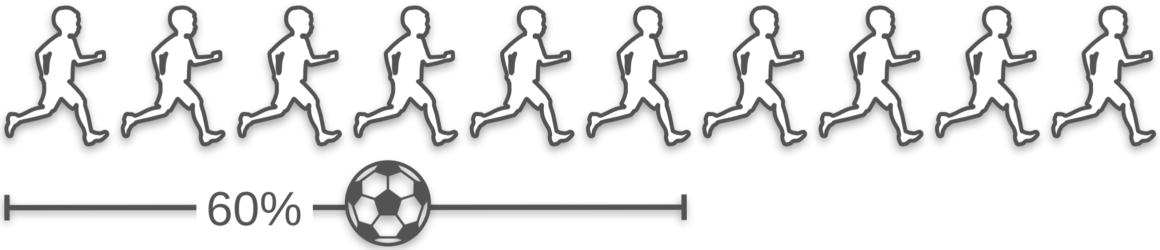
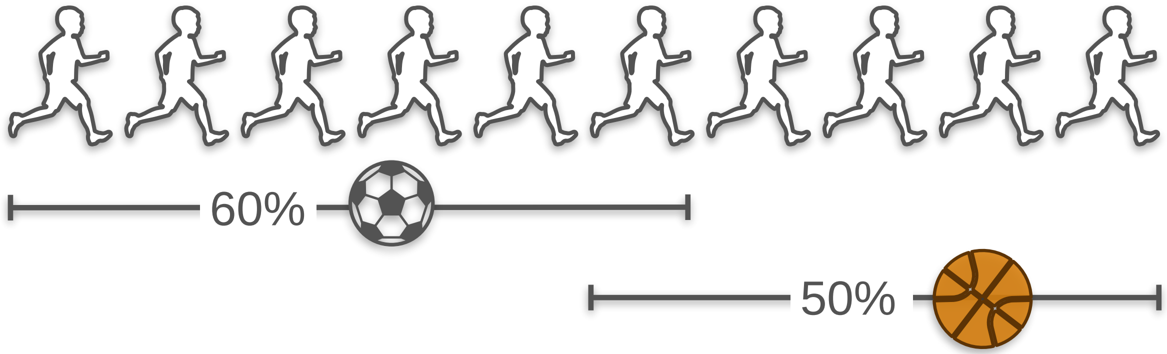
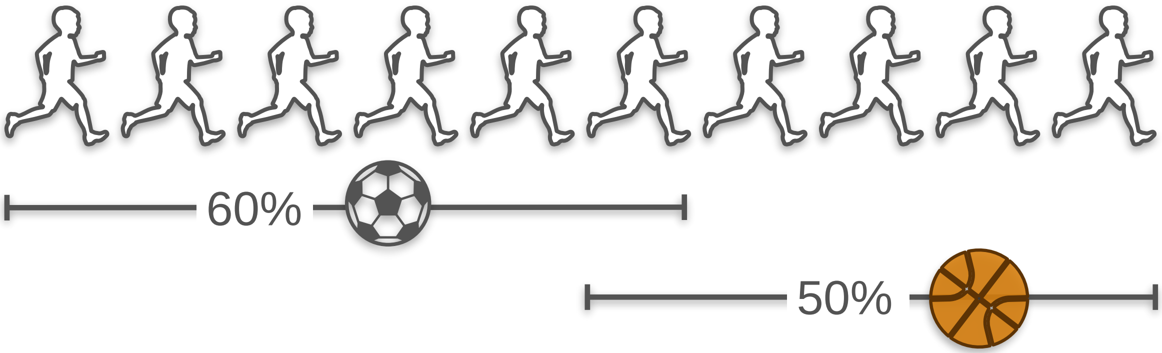


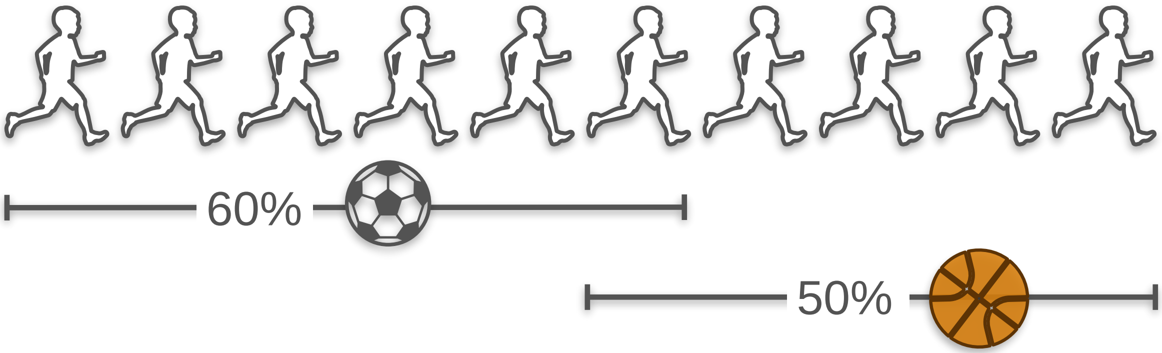
Sum of Probabilities (Joint Events): Quiz 1 Solution



Sum of Probabilities (Joint Events): Quiz 1 Solution

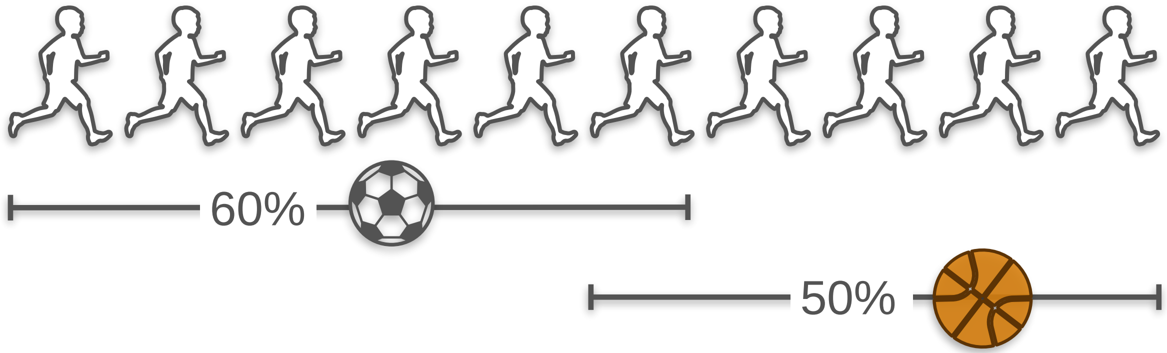


Sum of Probabilities (Joint Events): Quiz 1 Solution



$$\mathbf{P}(\text{soccer} \cup \text{basketball}) = ?$$

Sum of Probabilities (Joint Events): Quiz 1 Solution



$\mathbf{P}(\text{soccer} \cup \text{basketball}) = ?$

We don’t know how many children play multiple sports

Sum of Probabilities (Joint Events): Quiz 1 Solution

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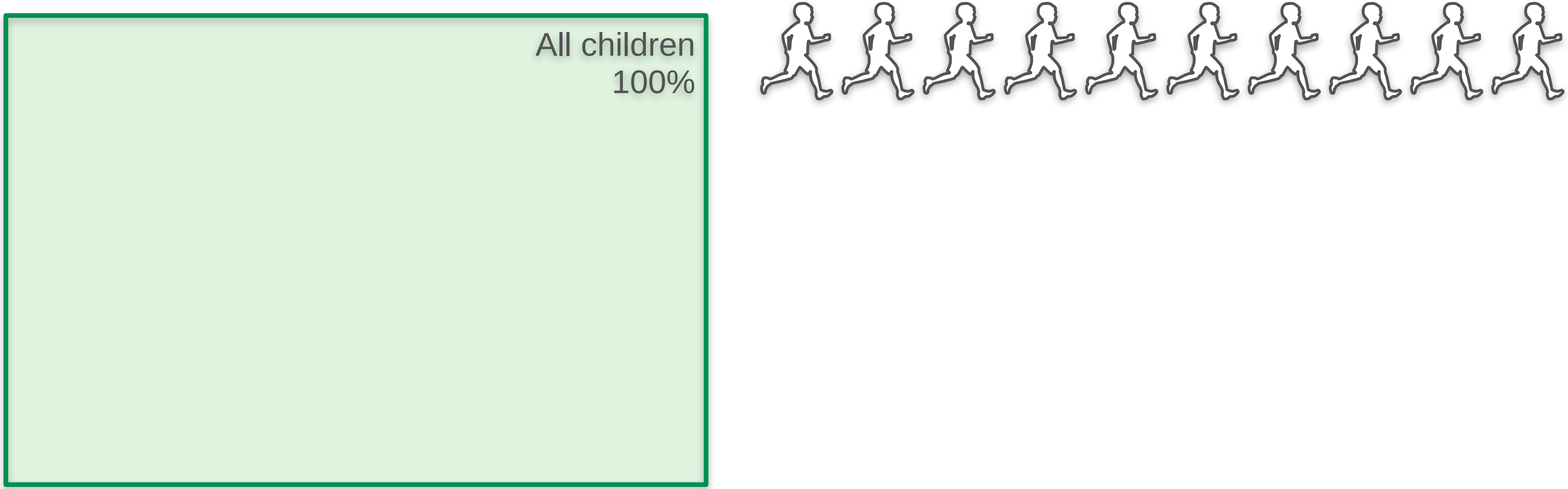
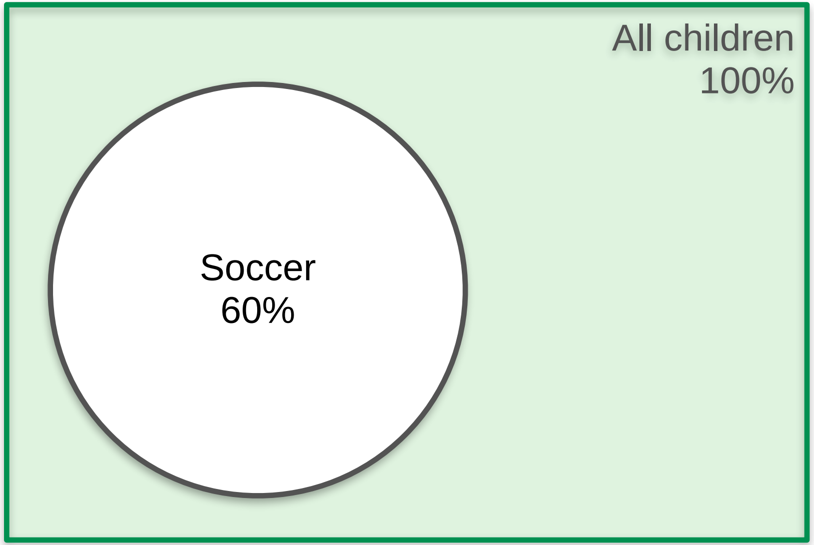
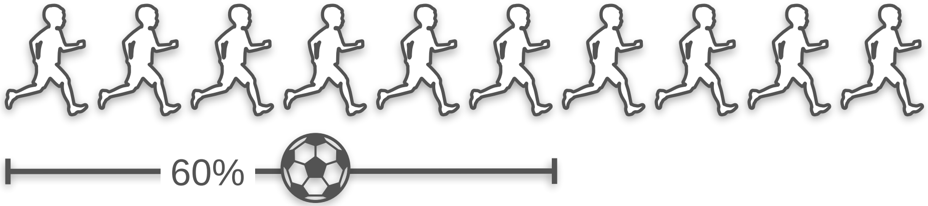
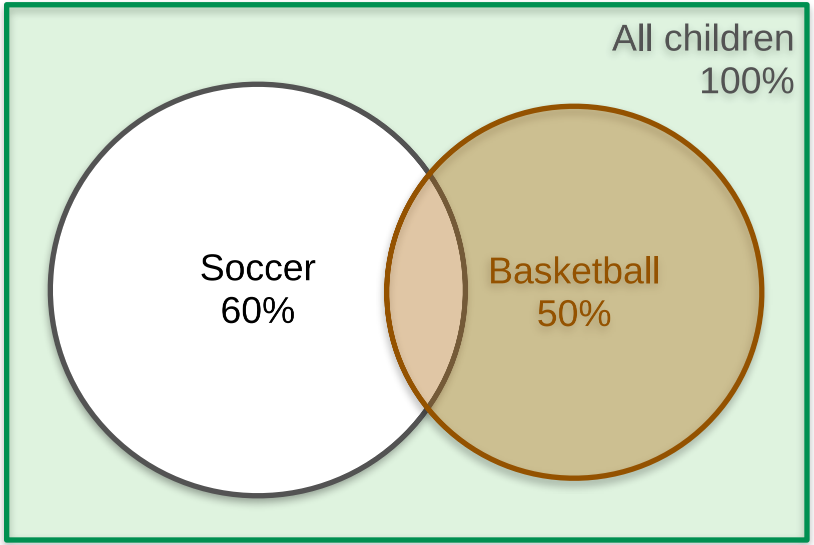


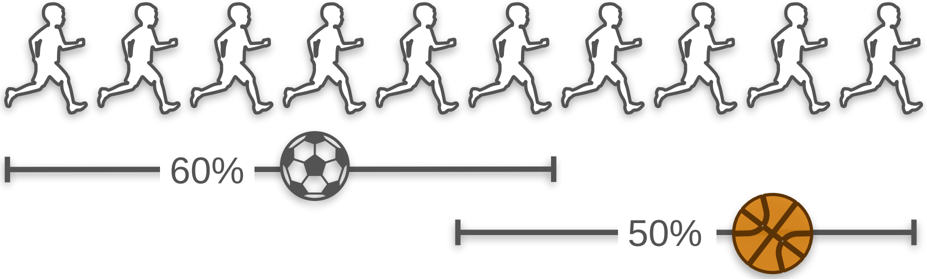
Sum of Probabilities (Joint Events): Quiz 1 Solution





Sum of Probabilities (Joint Events): Quiz 1 Solution





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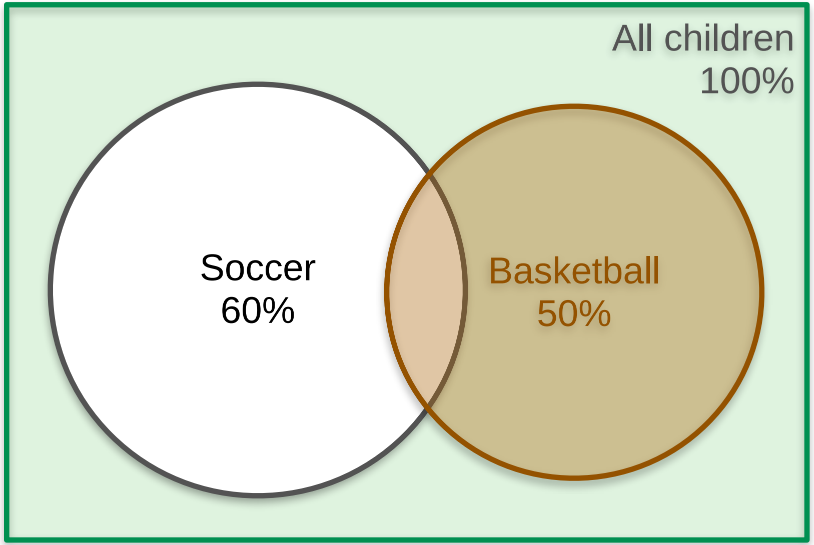
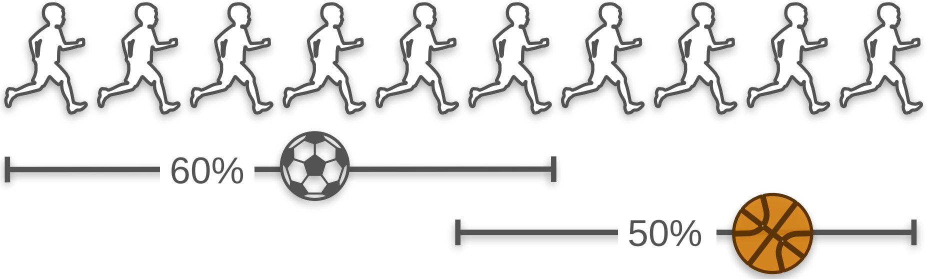
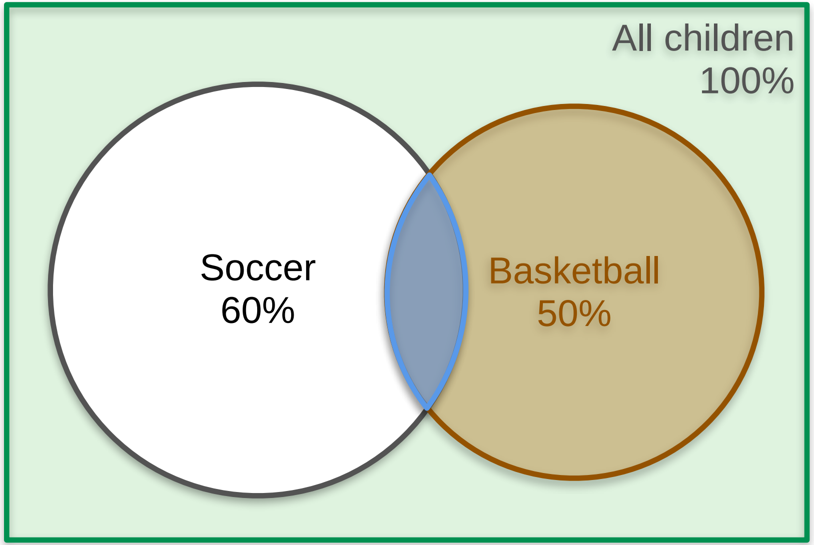
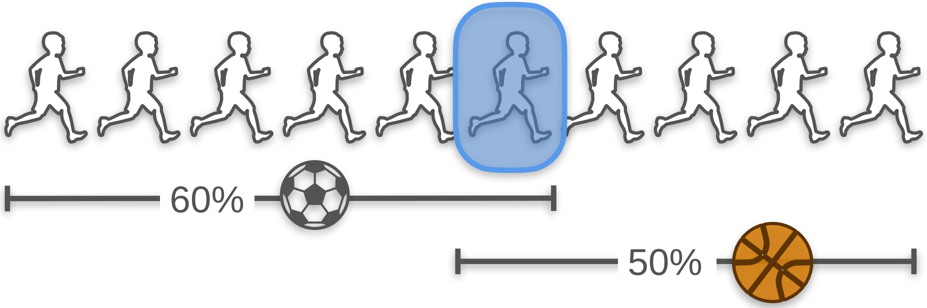




$$\mathbf{P}(S \cup B) = \mathbf{P}(S) + \mathbf{P}(B)$$

Sum of Probabilities (Joint Events): Quiz 1 Solution





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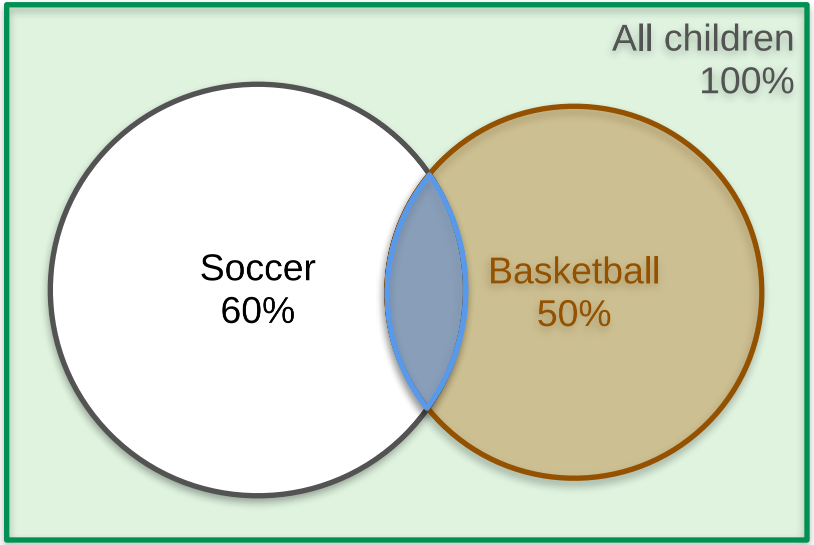
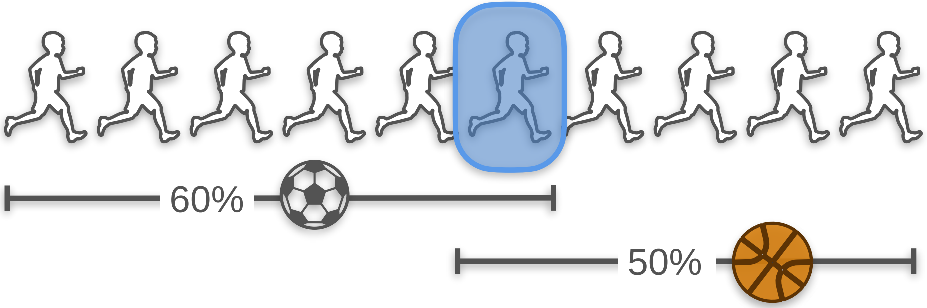


$\mathbf{P}(S \cap B)$



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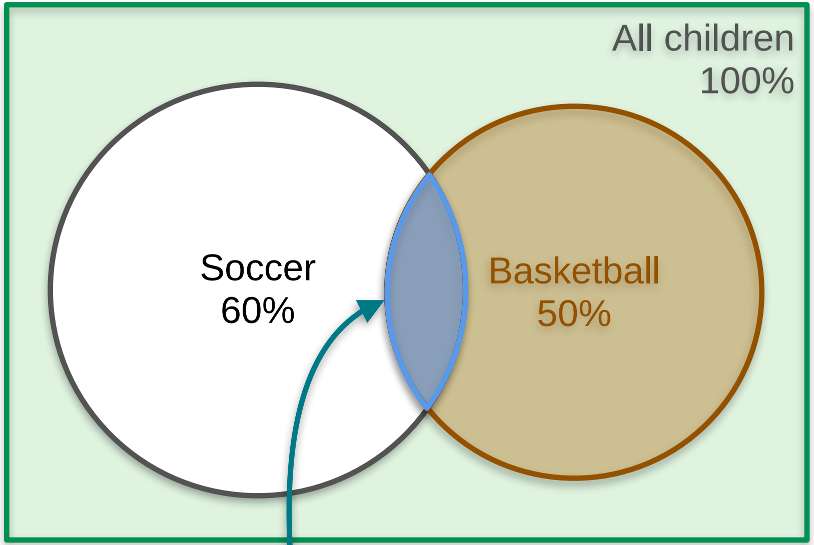
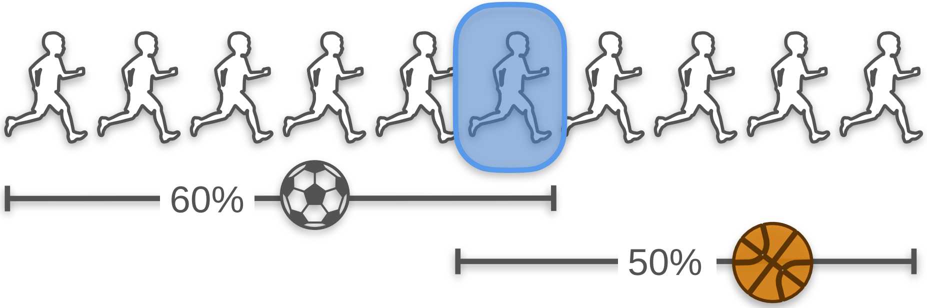


$\mathbf{P}(S \cap B)$



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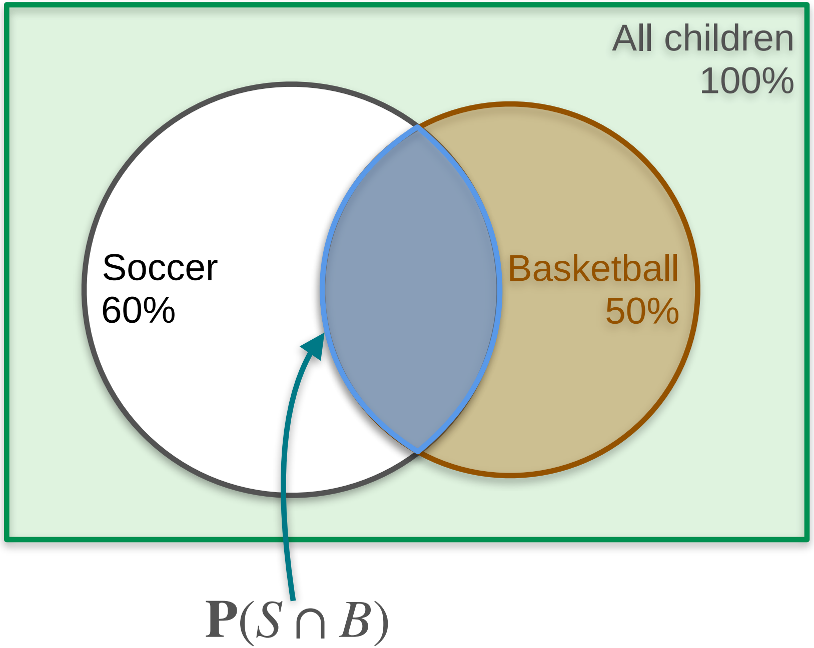
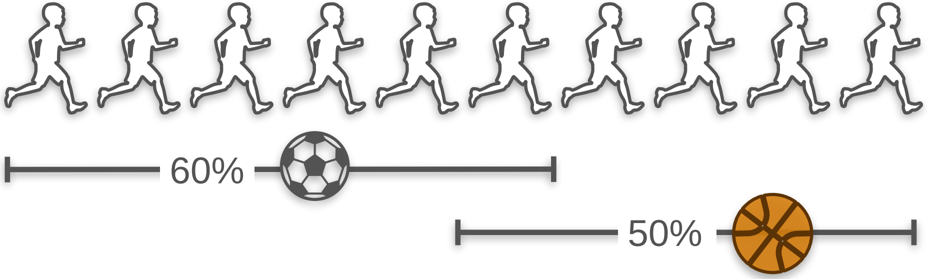
Sum of Probabilities (Joint Events): Quiz 1 Solution





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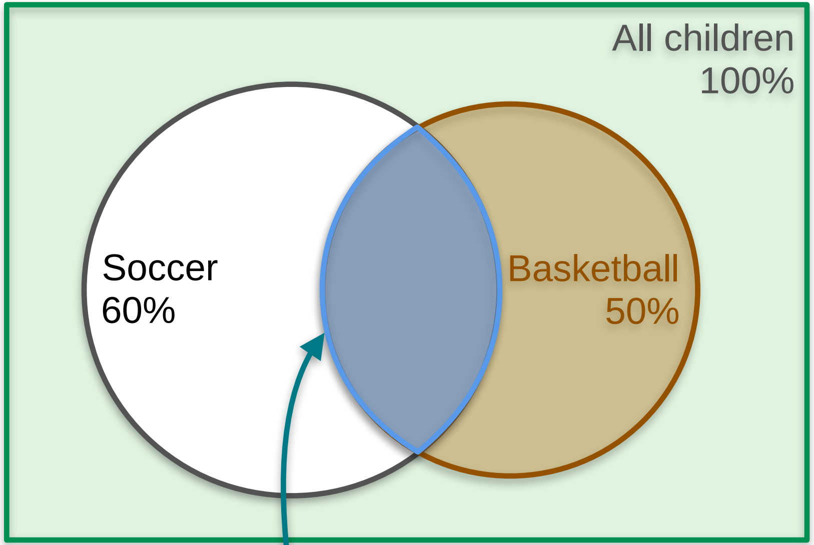
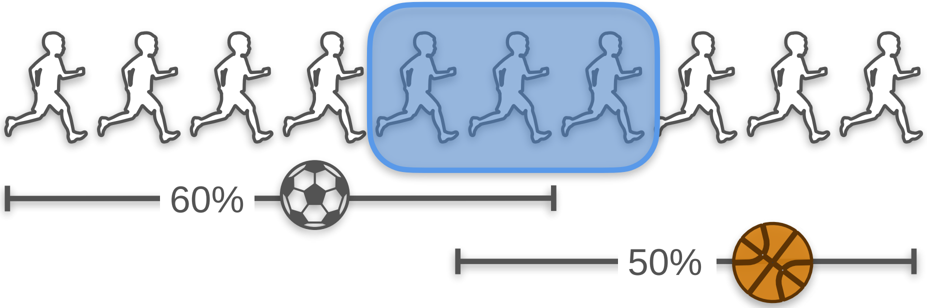
Sum of Probabilities (Joint Events): Quiz 1 Solution



$\mathbf{P}(S \cap B)$



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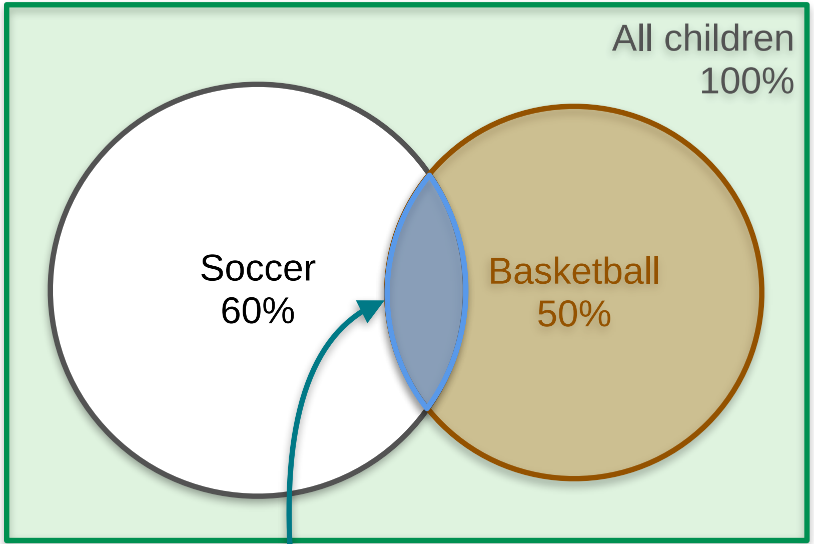
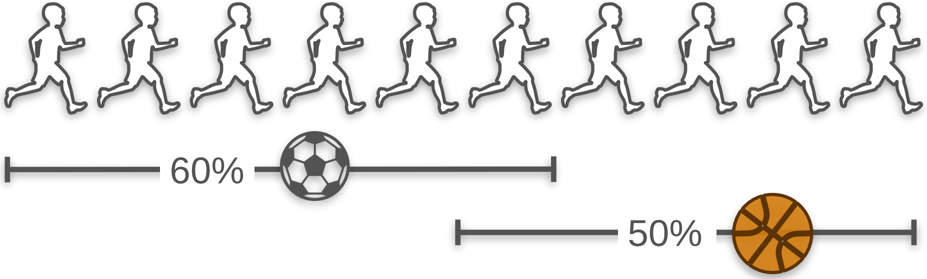


$\mathbf{P}(S \cap B)$



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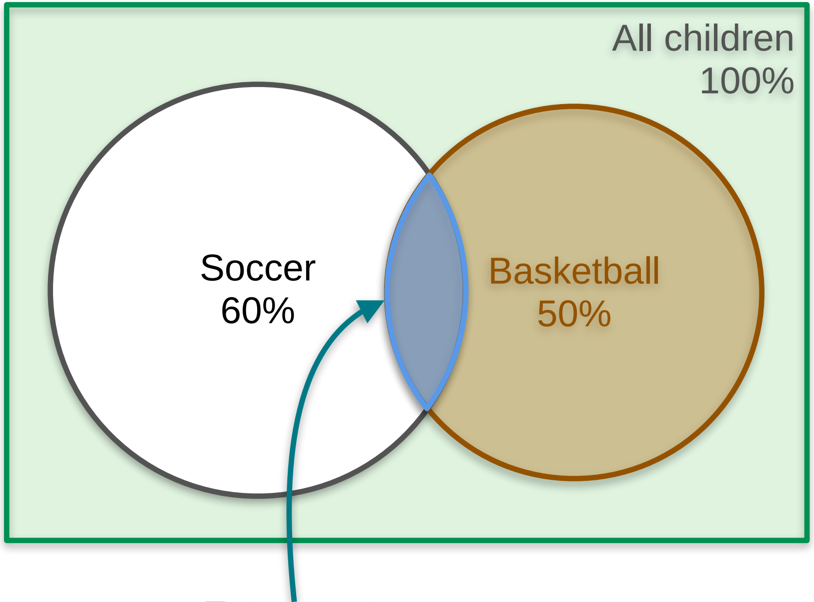
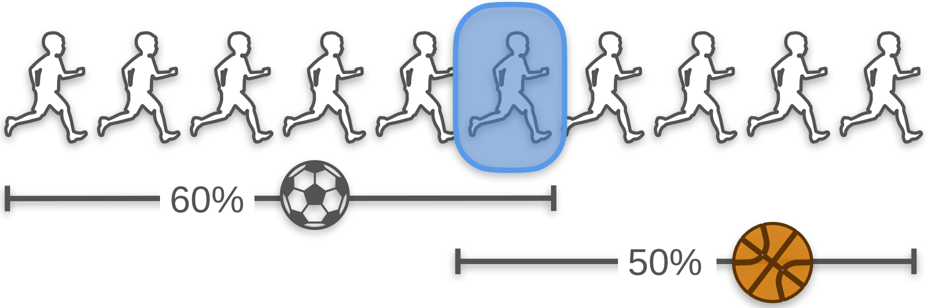


$\mathbf{P}(S \cap B)$



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Sum of Probabilities (Joint Events): Quiz 2

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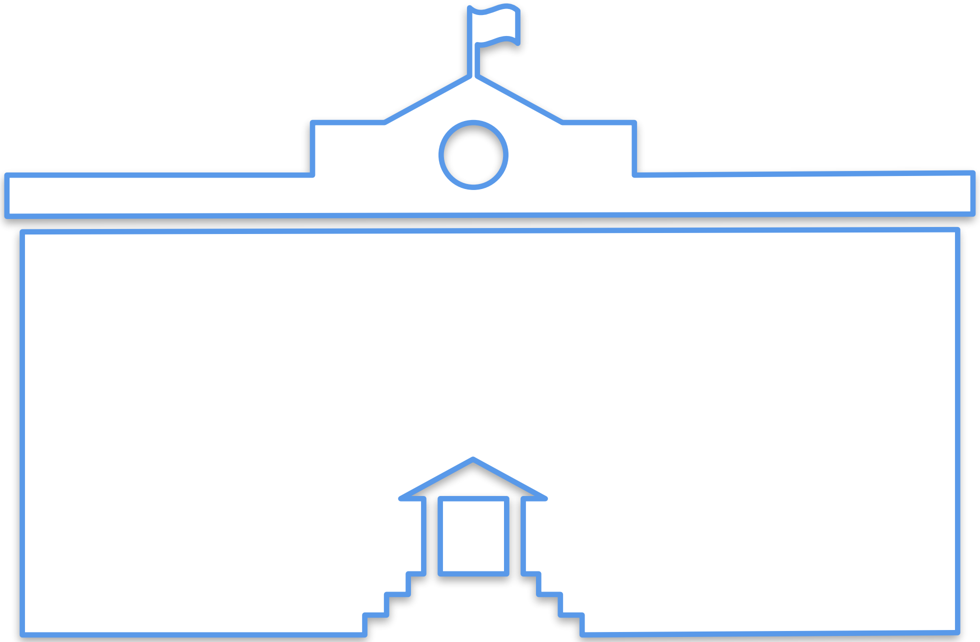

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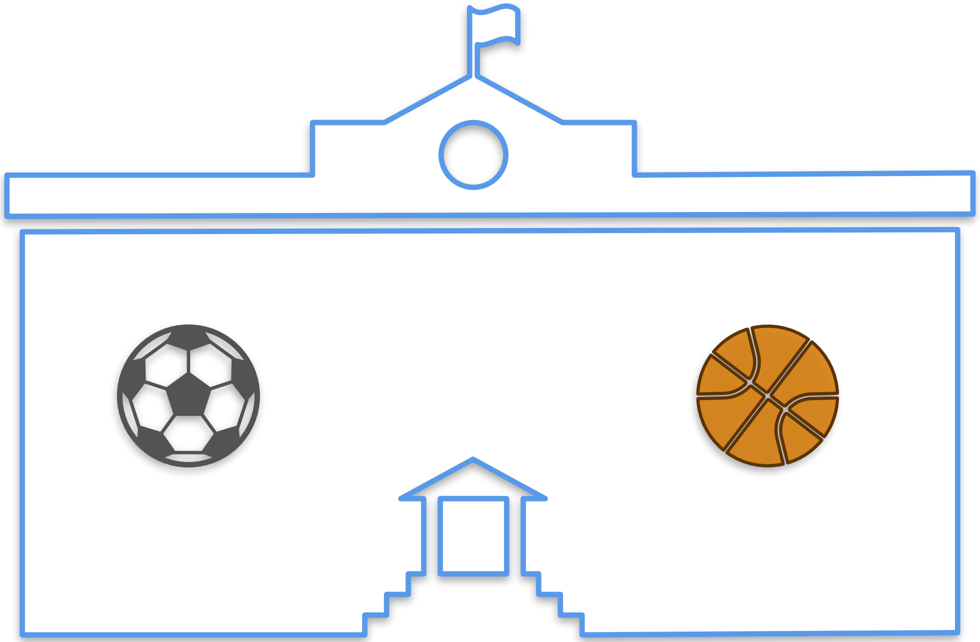

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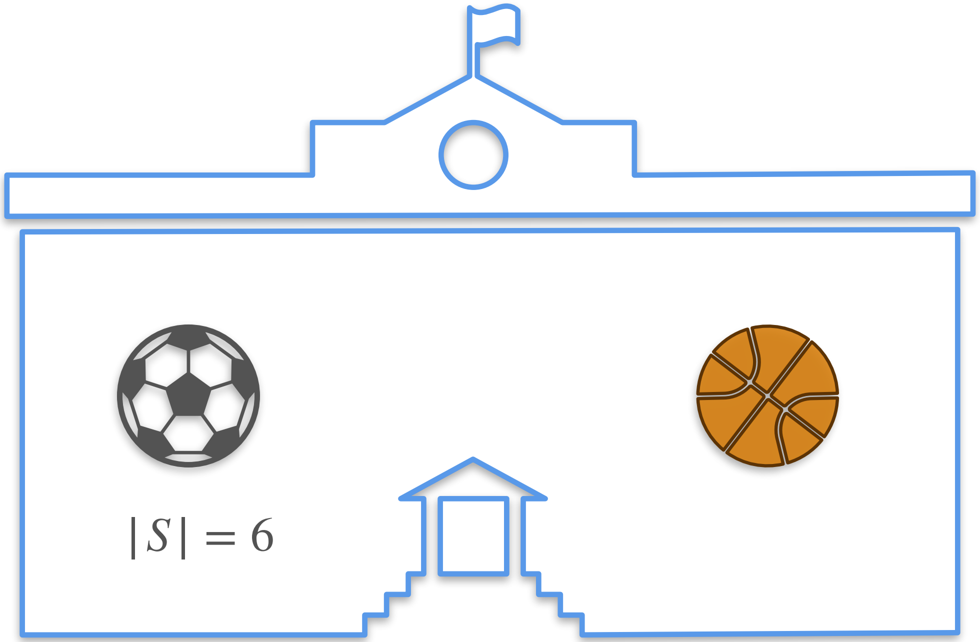

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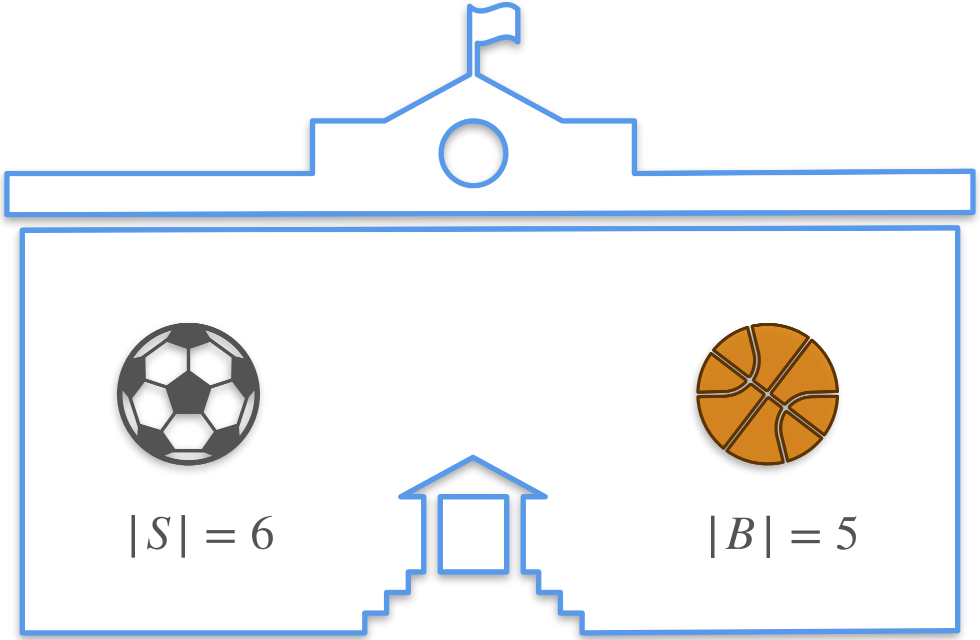

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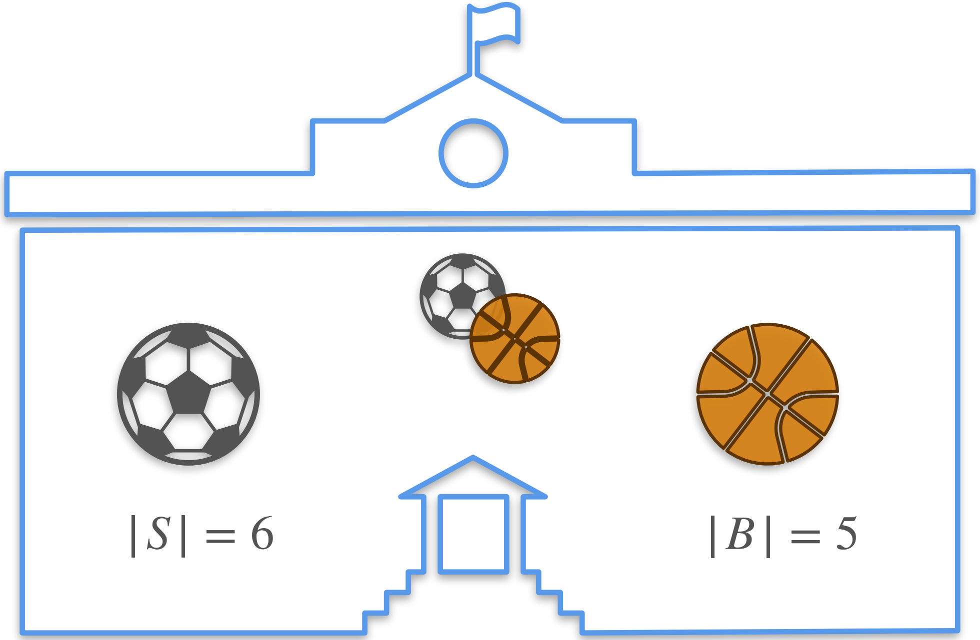

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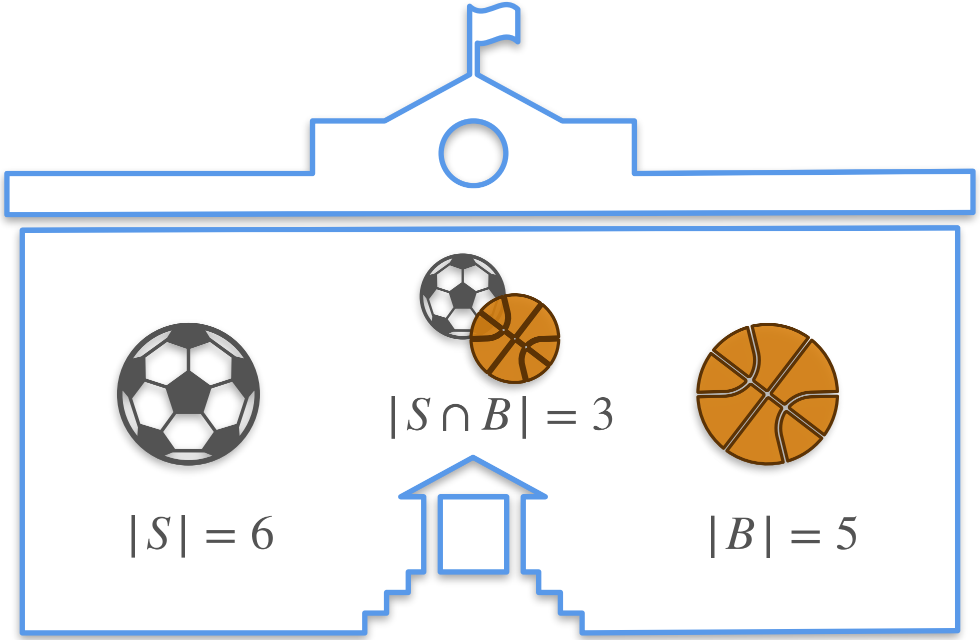

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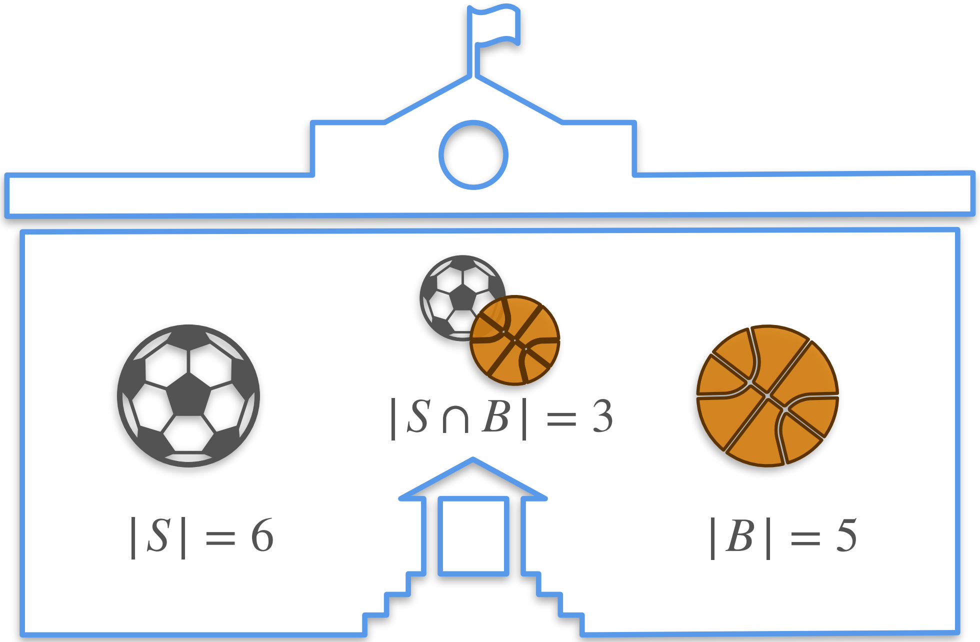
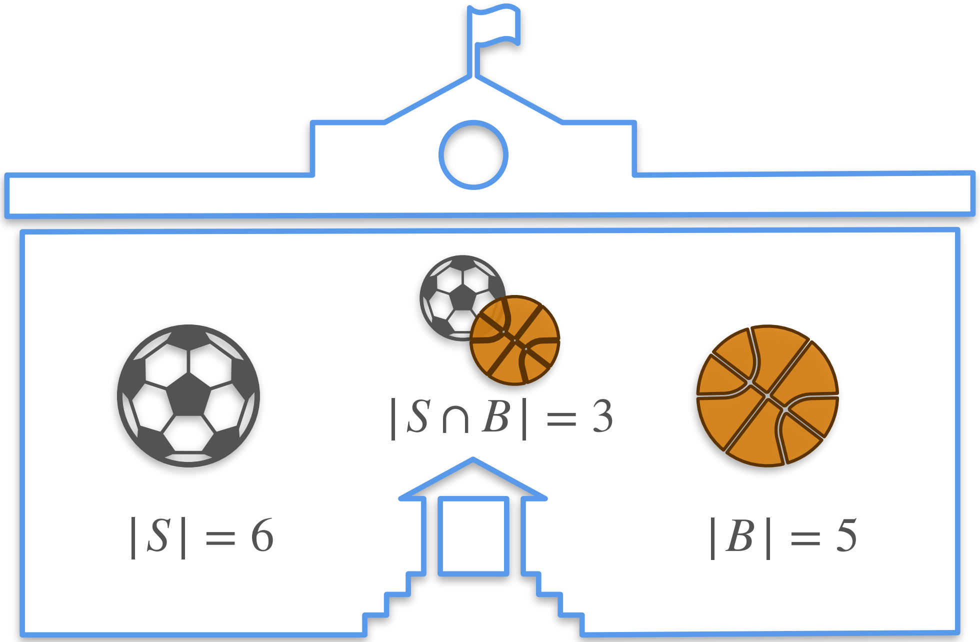


How many kids play soccer or basketball?

Sum of Probabilities (Joint Events): Quiz 2



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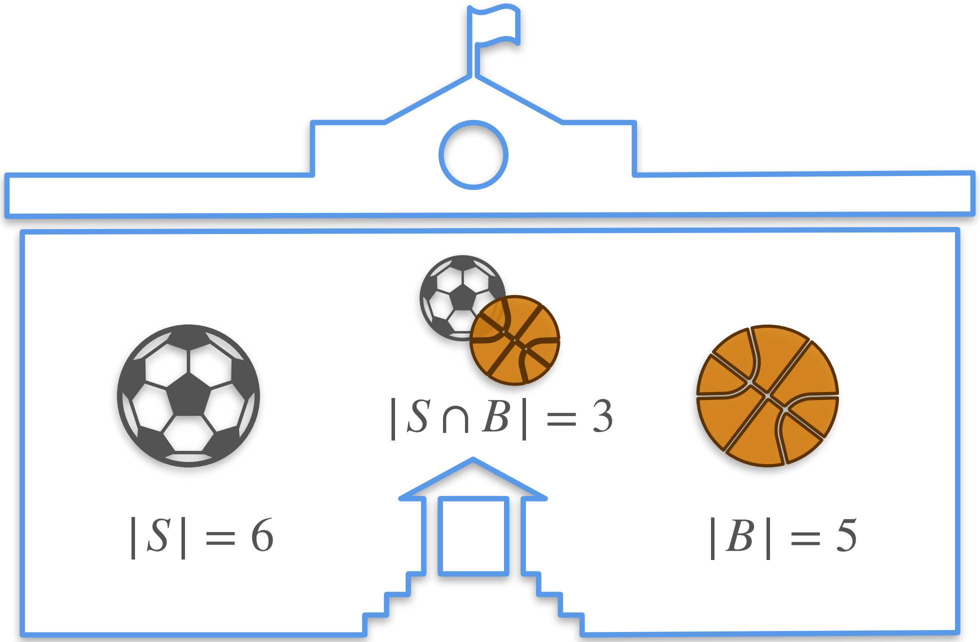

How many kids play soccer or basketball?

Hint: What if there were only 10 kids?

Sum of Probabilities (Joint Events): Quiz 2 Solution

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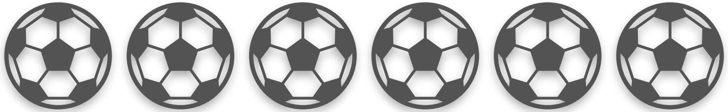

Sum of Probabilities (Joint Events): Quiz 2 Solution

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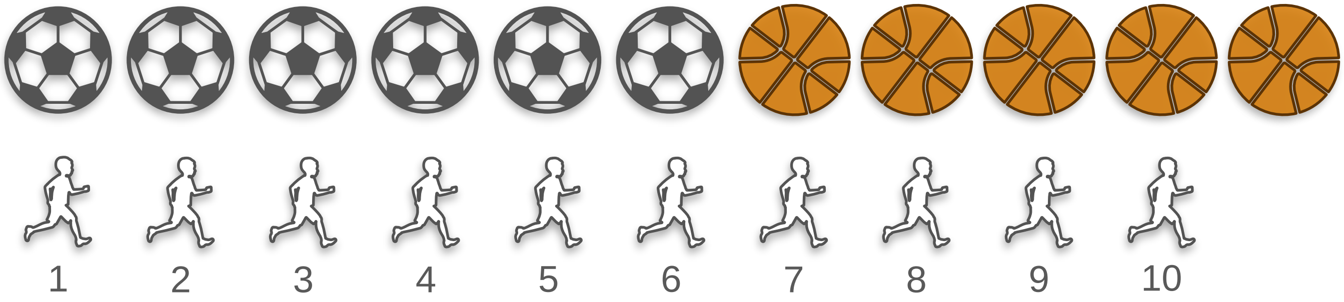

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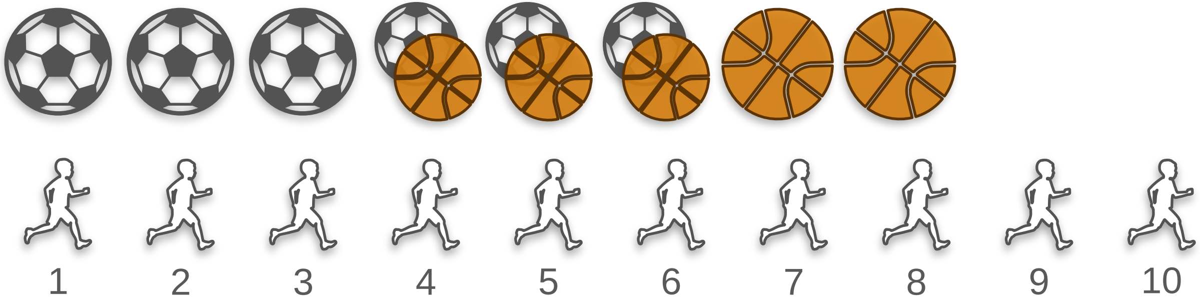

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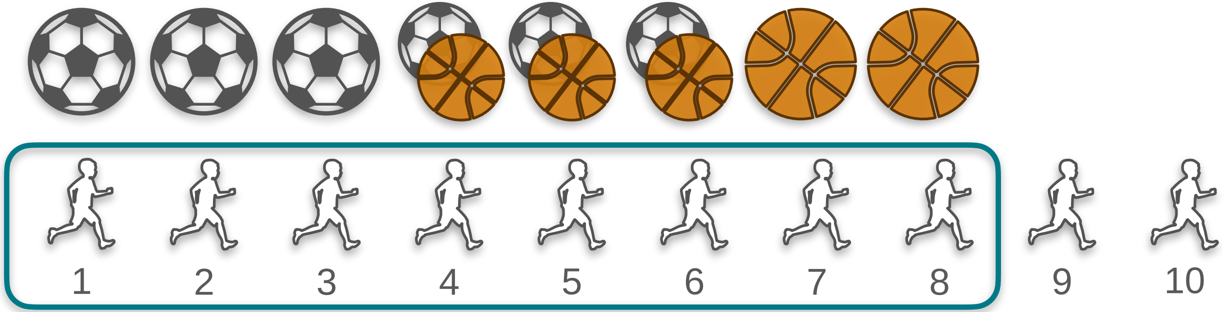

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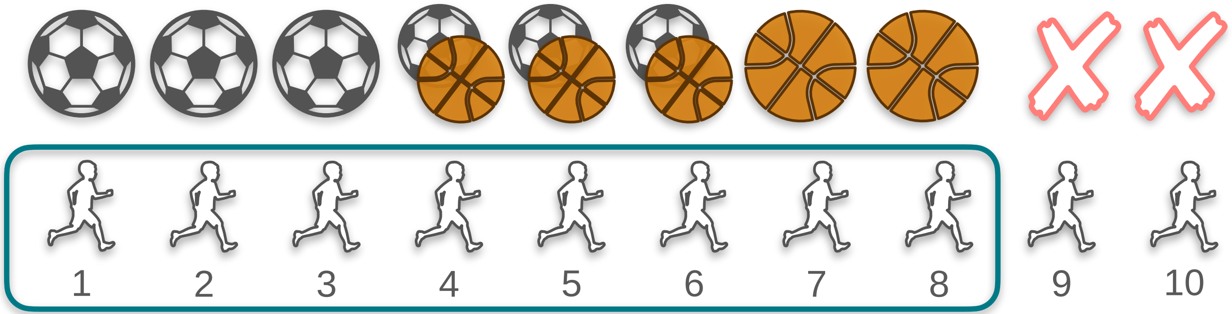

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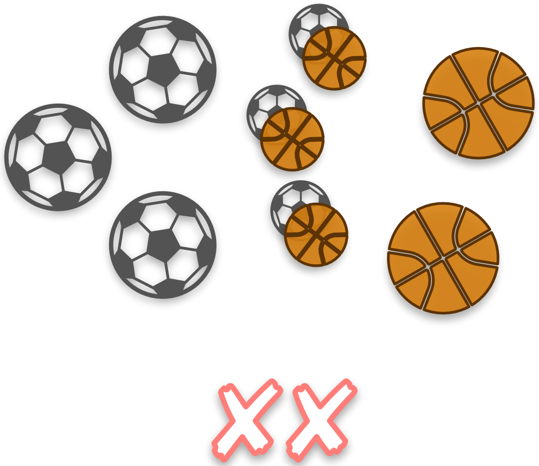
Sum of Probabilities (Joint Events): Venn Diagram



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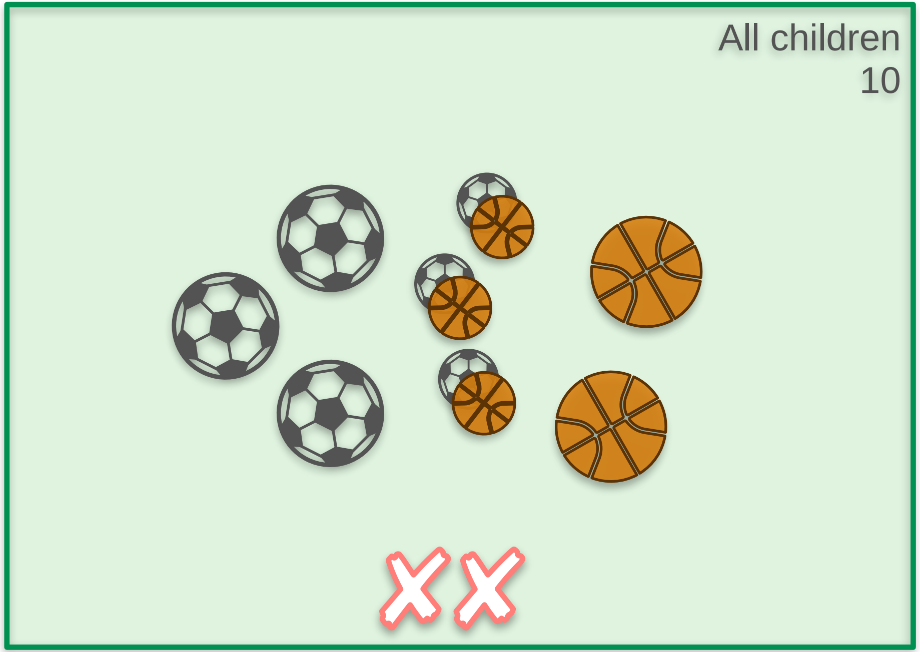

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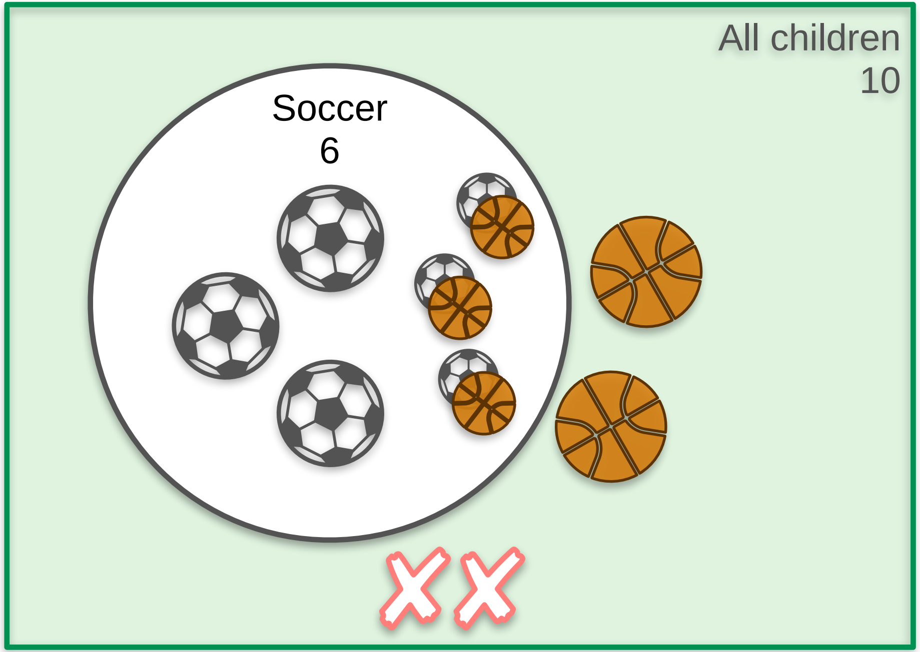

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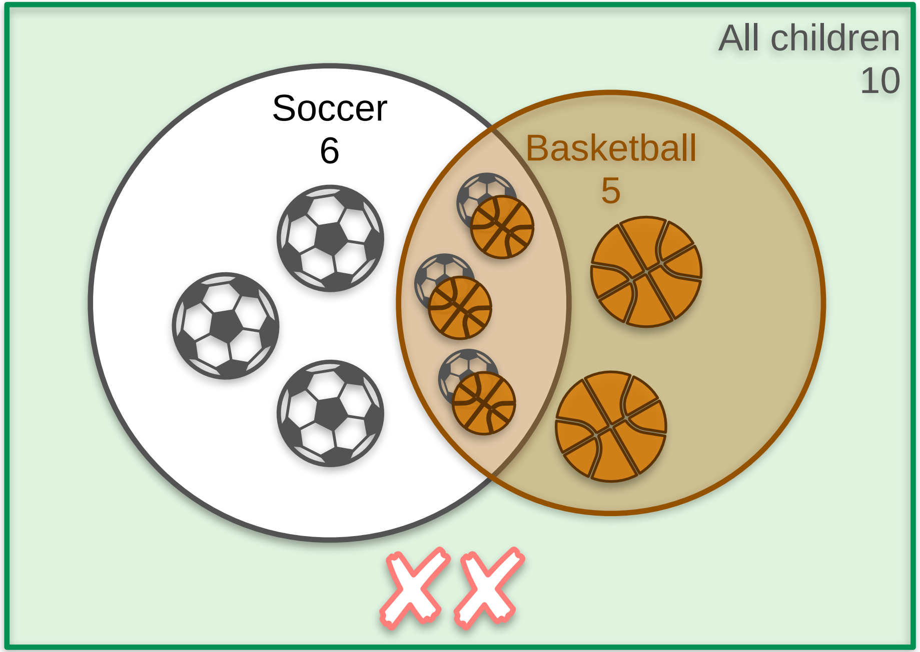
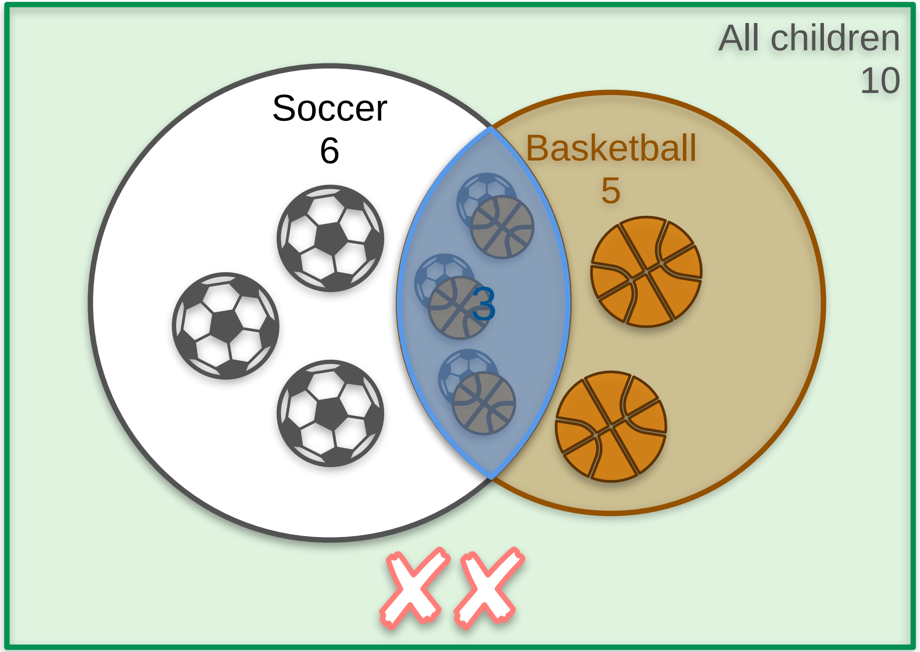
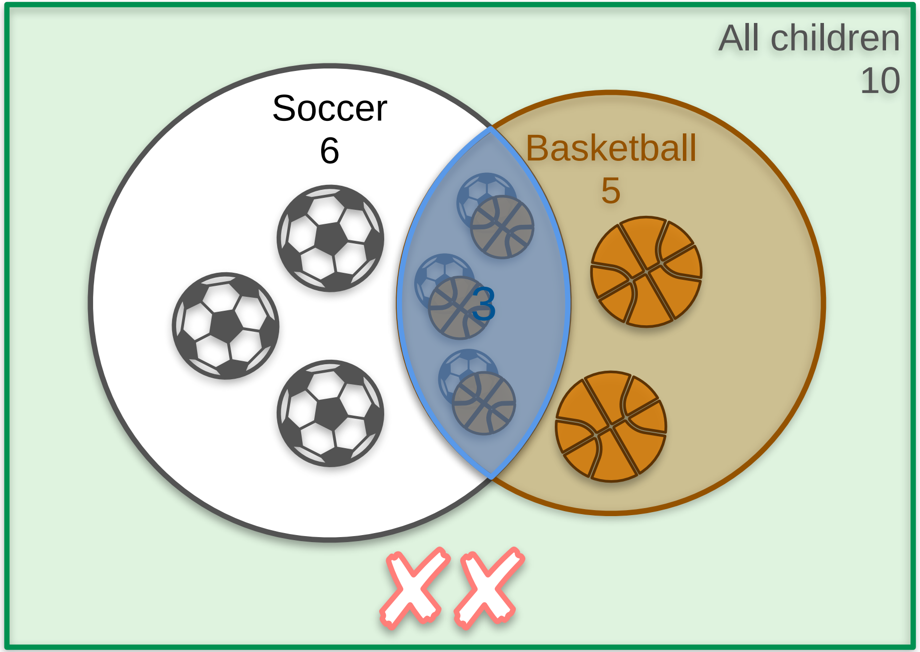


Sum of Probabilities (Joint Events): Venn Diagram

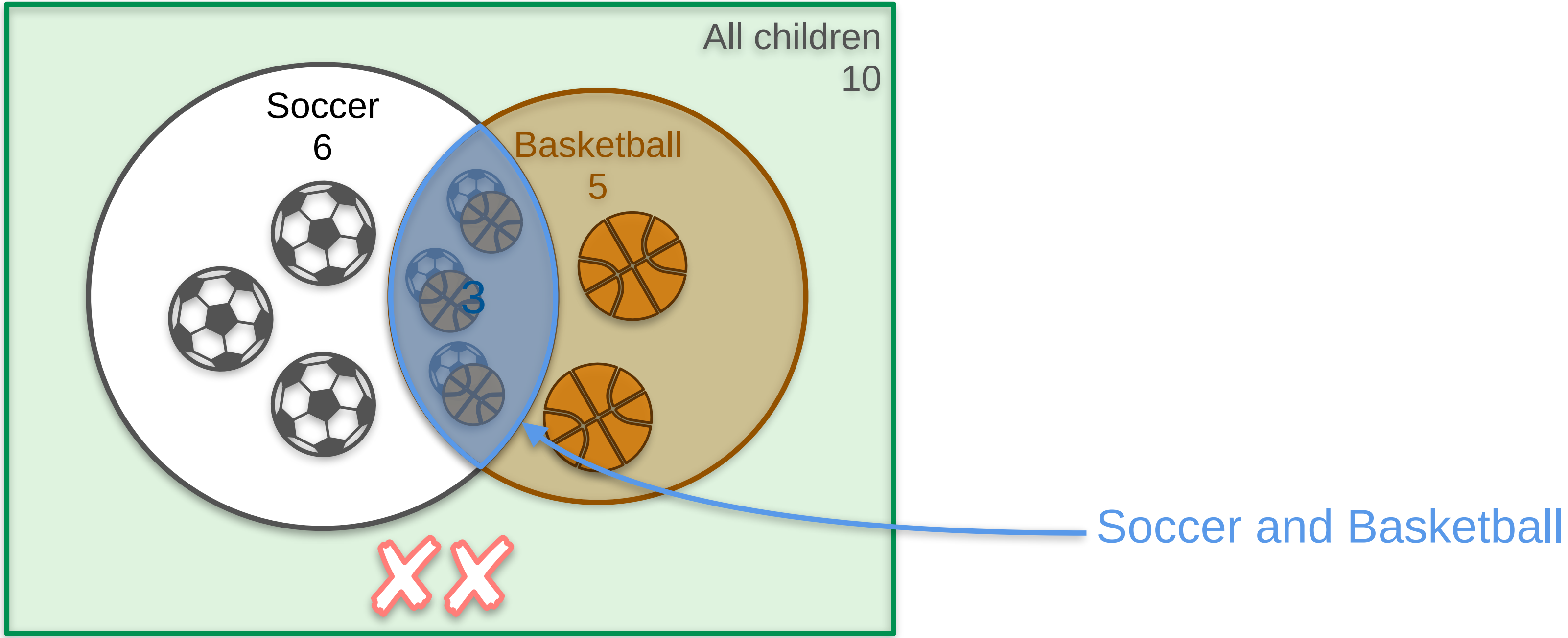


Sum of Probabilities (Joint Events): Venn Diagram

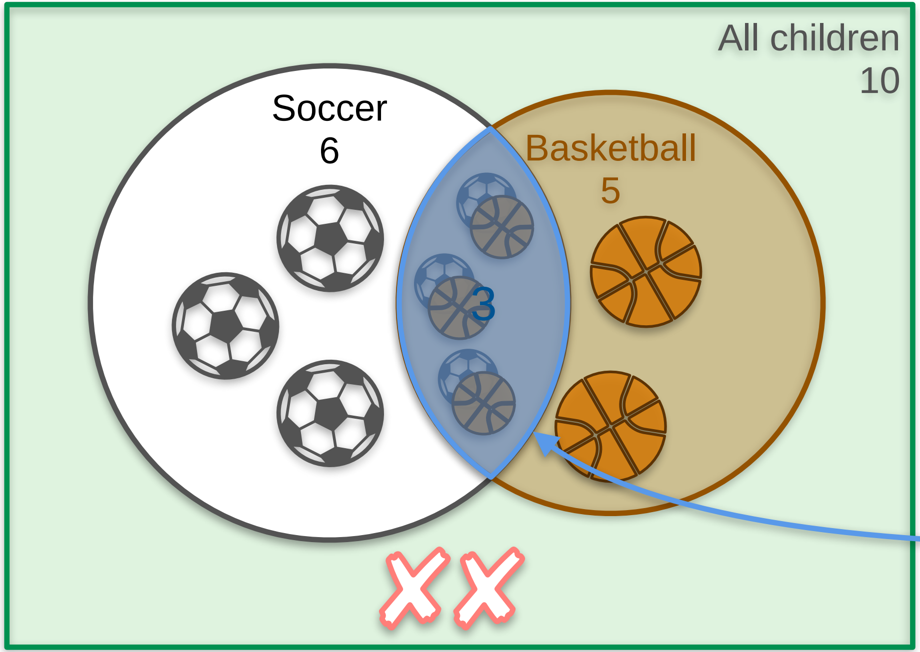


Soccer and Basketball

Sum of Probabilities (Joint Events): Venn Diagram



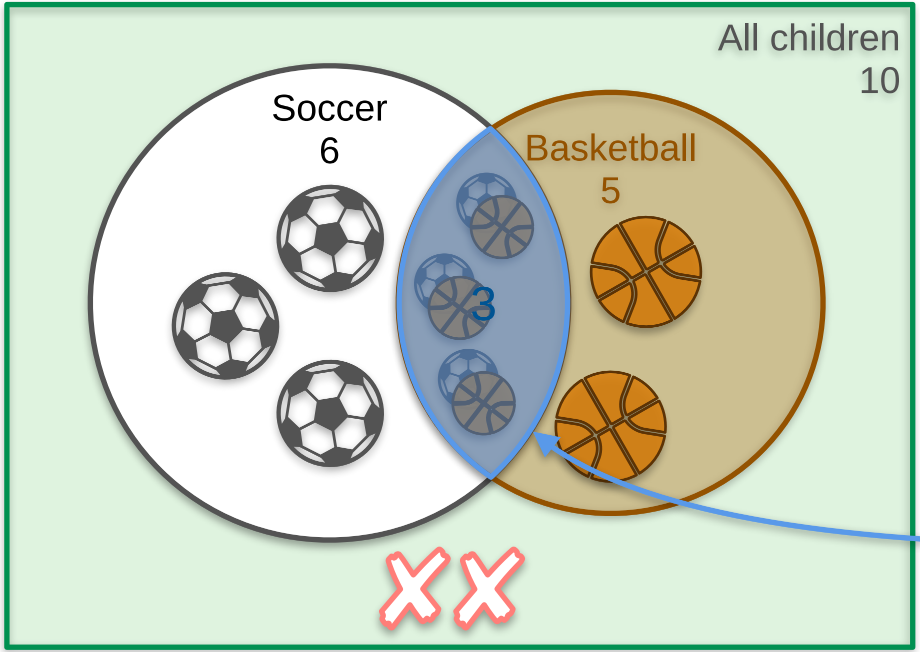
Sum of Probabilities (Joint Events): Venn Diagram



$$|S \cup B| \ =$$

Soccer and Basketball

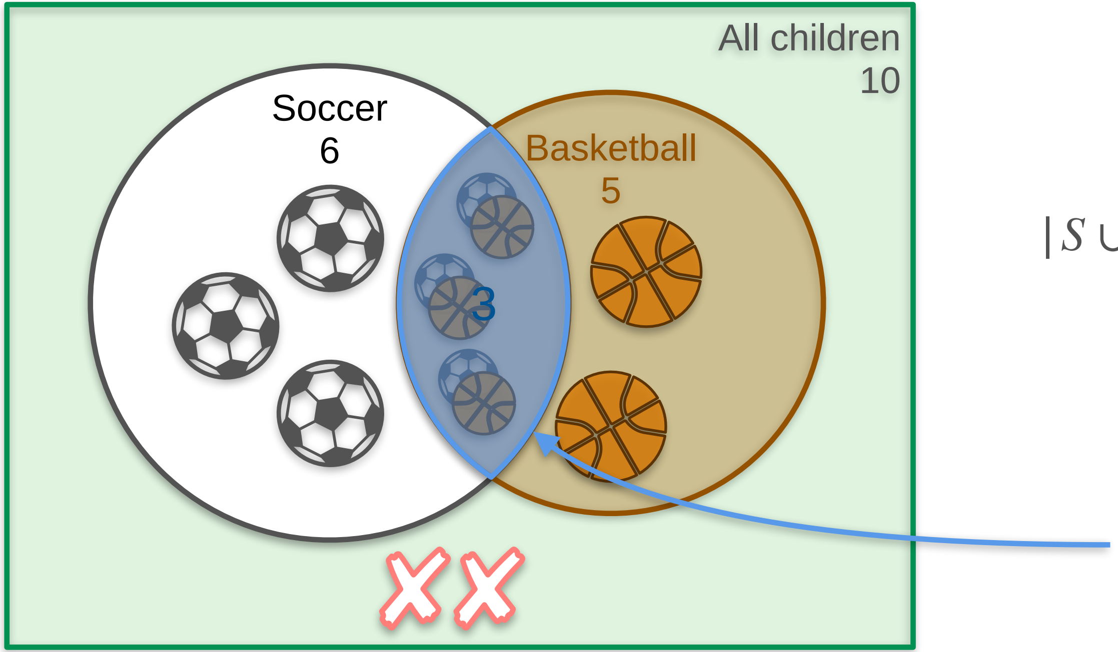
Sum of Probabilities (Joint Events): Venn Diagram

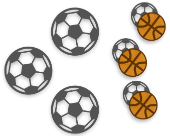


$$|S \cup B| = |S|$$

Soccer and Basketball

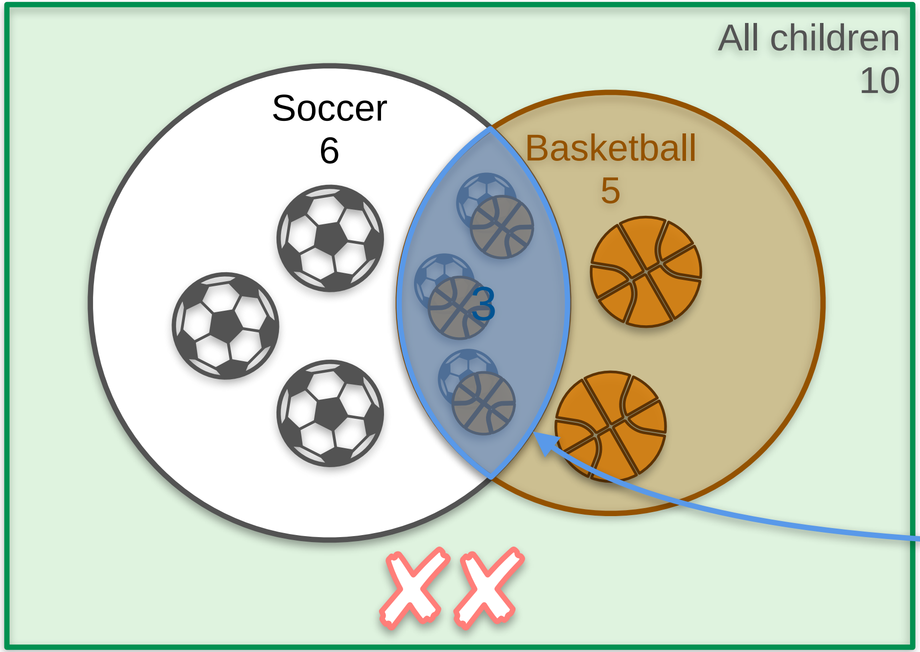
Sum of Probabilities (Joint Events): Venn Diagram





$$|S \cup B| = |S|$$

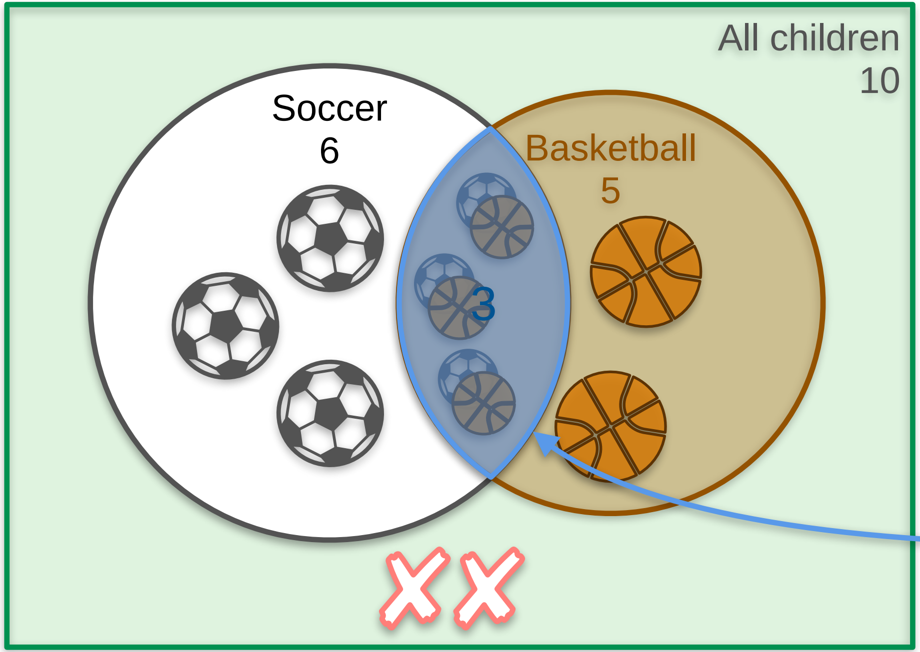
Sum of Probabilities (Joint Events): Venn Diagram

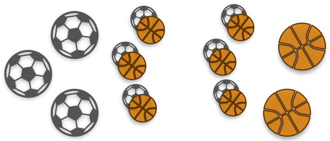


$$|S \cup B| = |S| + |B|$$

Soccer and Basketball

Sum of Probabilities (Joint Events): Venn Diagram

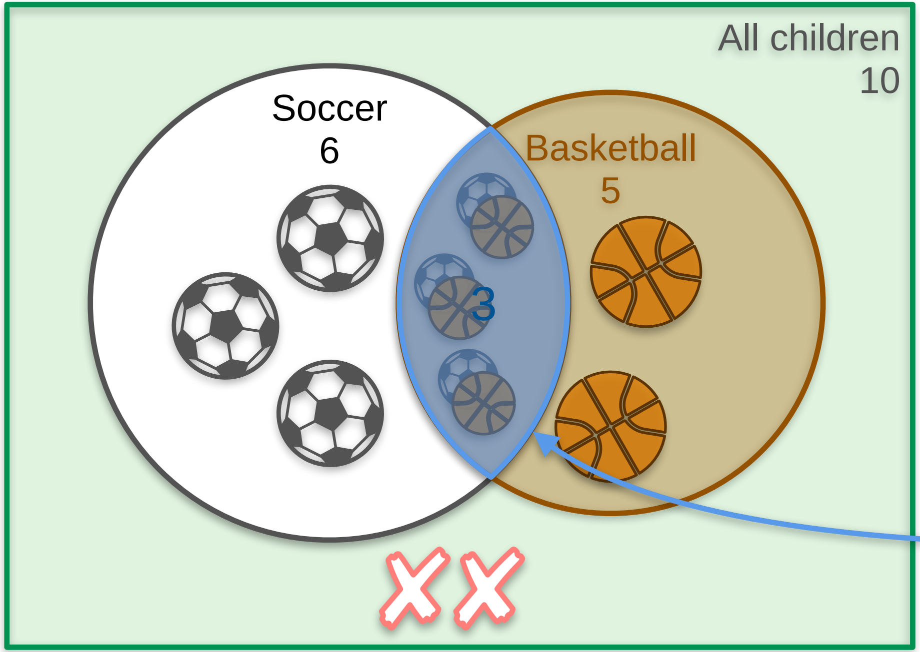


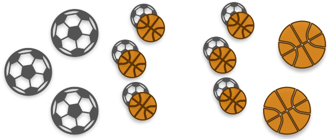


$$|S \cup B| = |S| + |B|$$

Soccer and Basketball

Sum of Probabilities (Joint Events): Venn Diagram

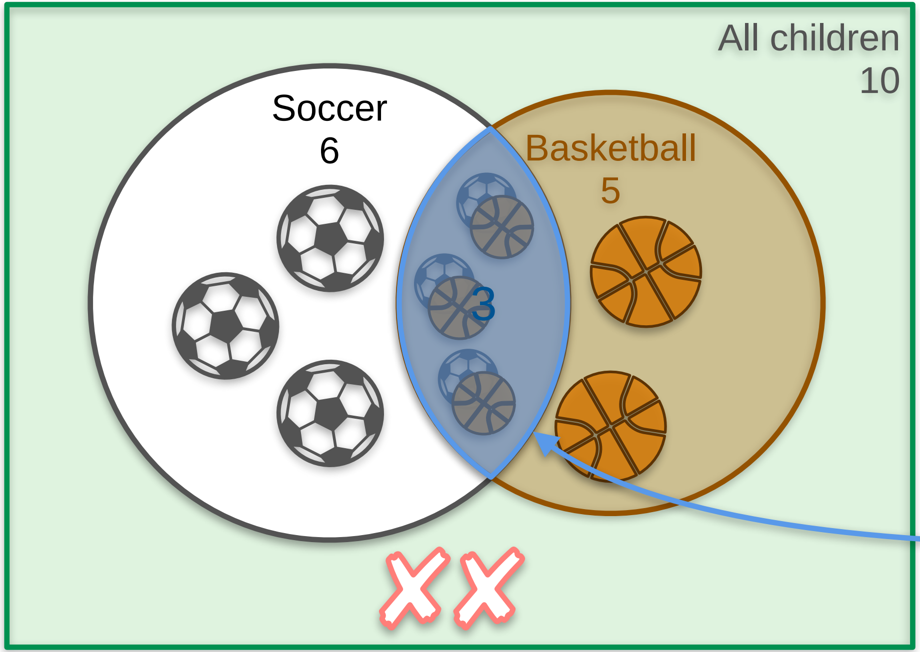


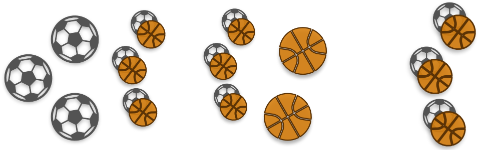


$$|S \cup B| = |S| + |B| - |S \cap B|$$

Soccer and Basketball

Sum of Probabilities (Joint Events): Venn Diagram

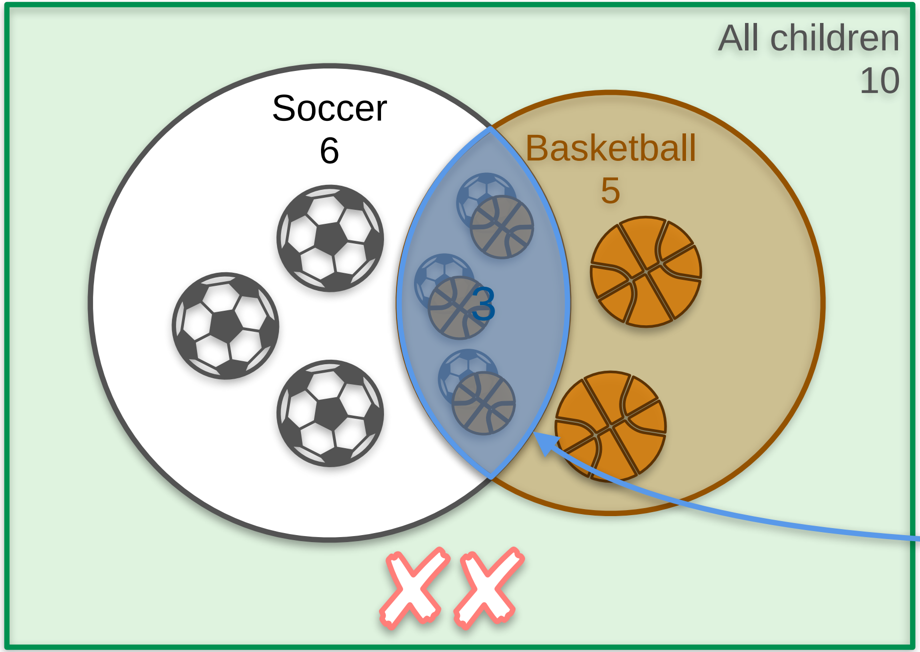


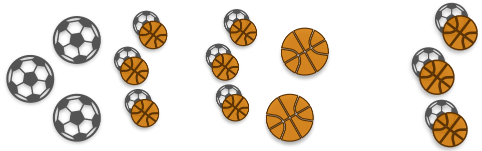


$$|S \cup B| = |S| + |B| - |S \cap B|$$

Soccer and Basketball

Sum of Probabilities (Joint Events): Venn Diagram



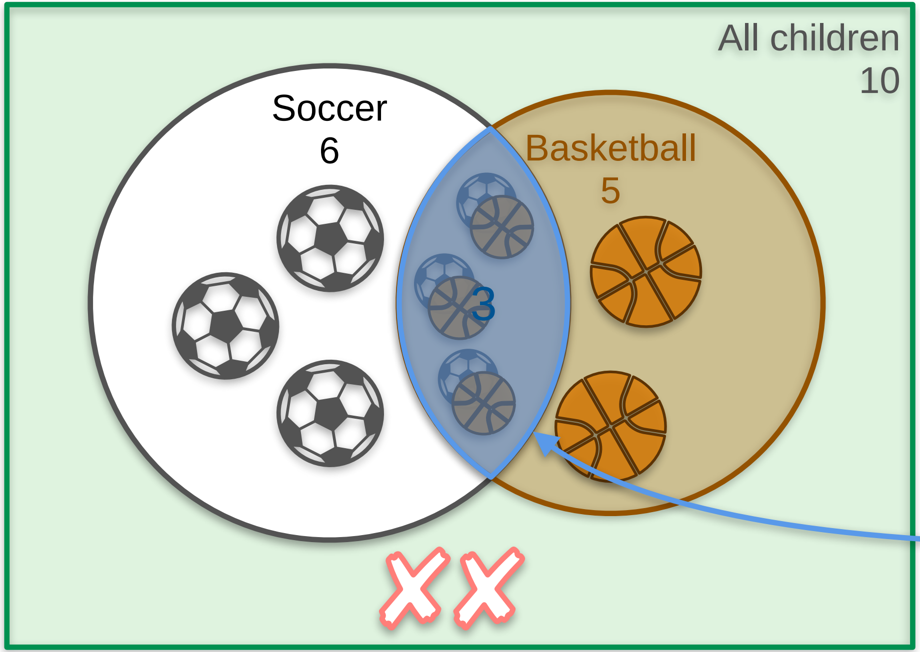


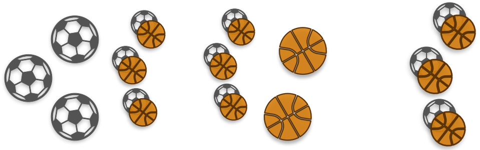
$$|S \cup B| = |S| + |B| - |S \cap B|$$

$$=$$

Soccer and Basketball

Sum of Probabilities (Joint Events): Venn Diagram



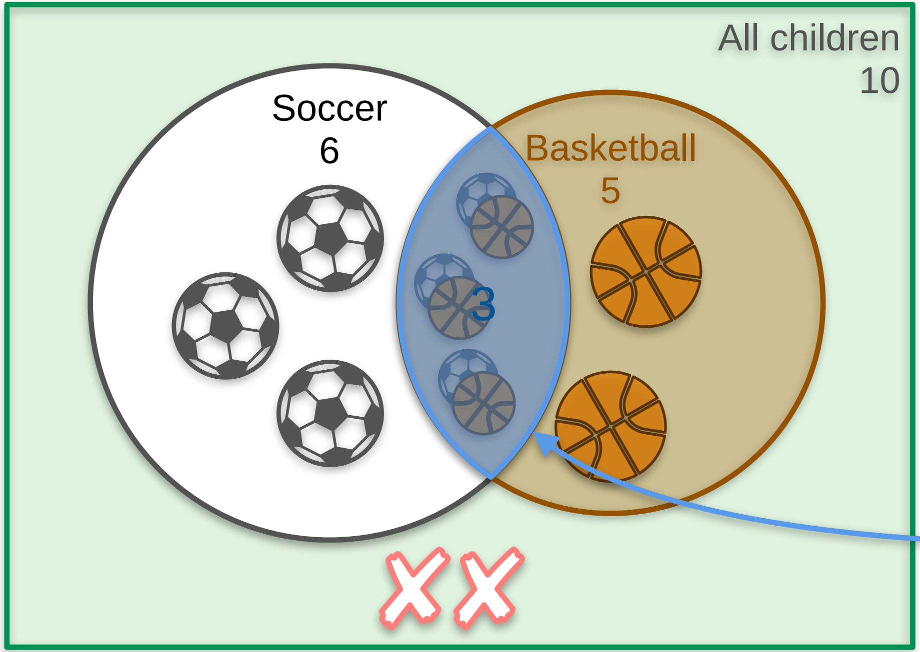


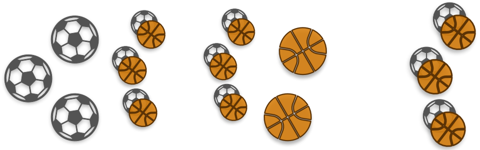
$$|S \cup B| = |S| + |B| - |S \cap B|$$

$$= 6 + 5 - 3$$

Soccer and Basketball

Sum of Probabilities (Joint Events): Venn Diagram



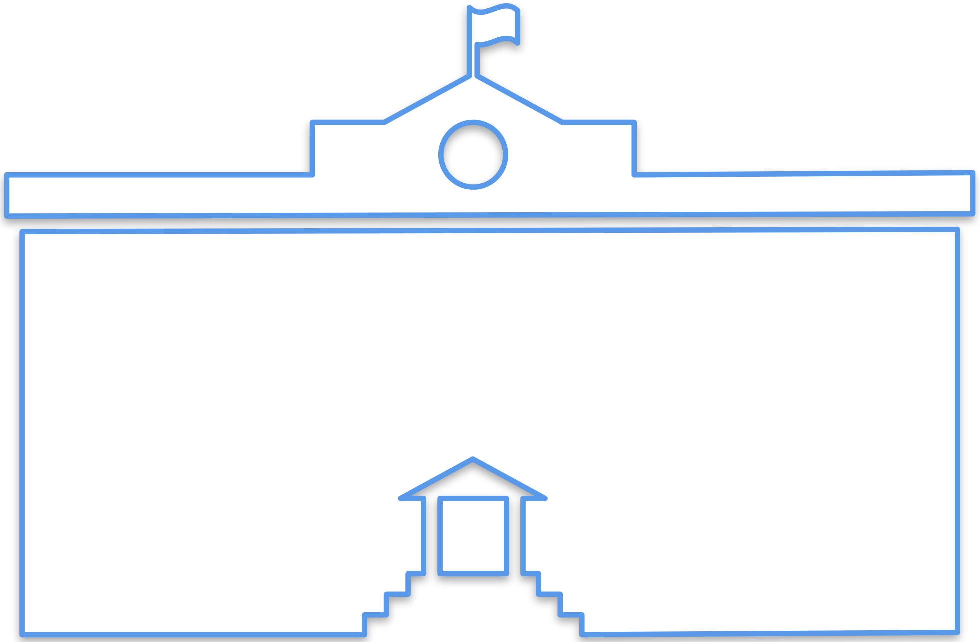


$$
\begin{aligned}
|S \cup B| &= |S| + |B| - |S \cap B| \\
&= 6 + 5 - 3 \\
&= 8
\end{aligned}
$$

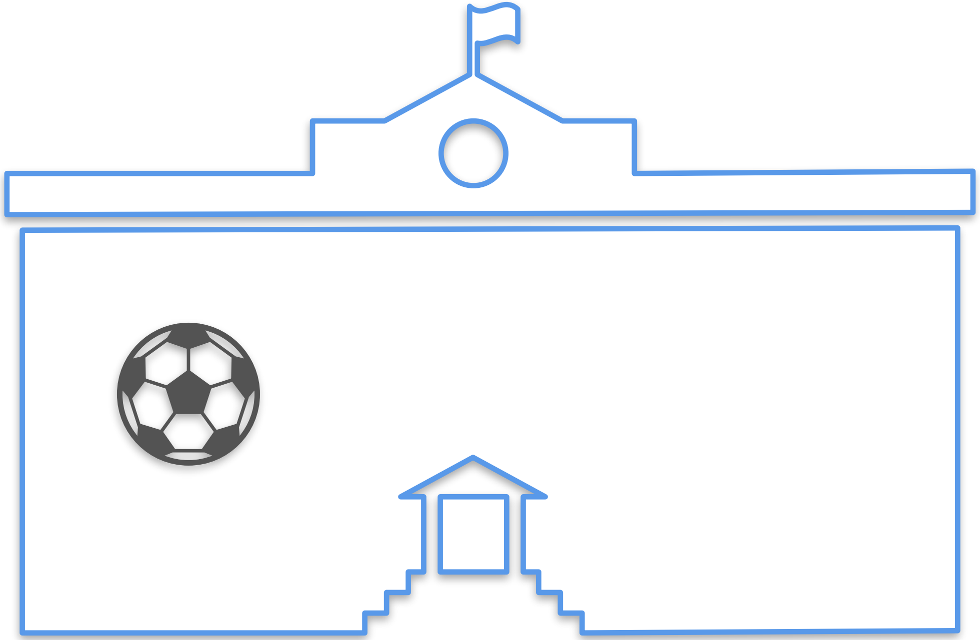
Soccer and Basketball

Sum of Probabilities (Joint Events): Quiz 3

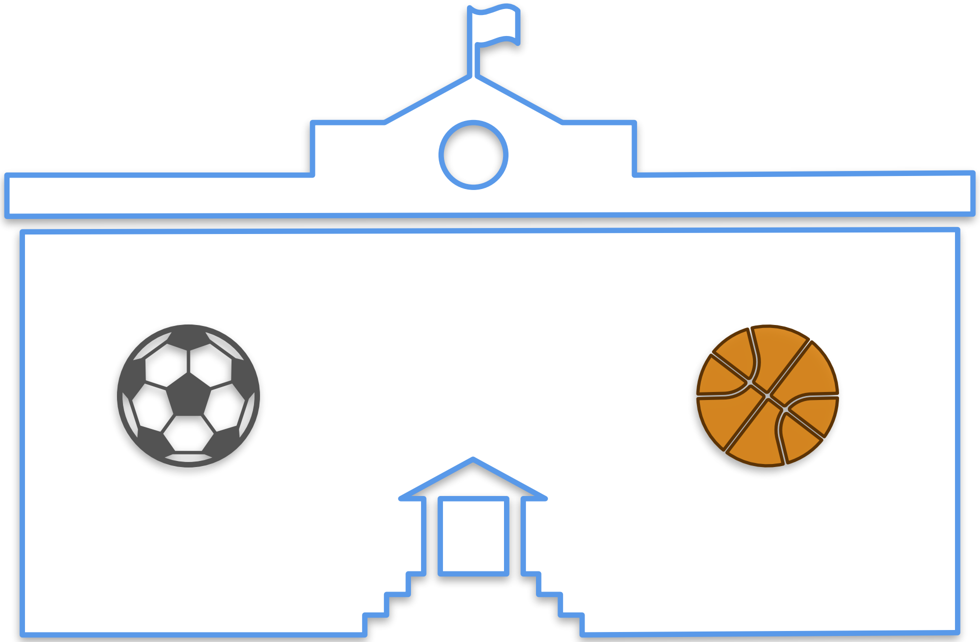
Sum of Probabilities (Joint Events): Quiz 3



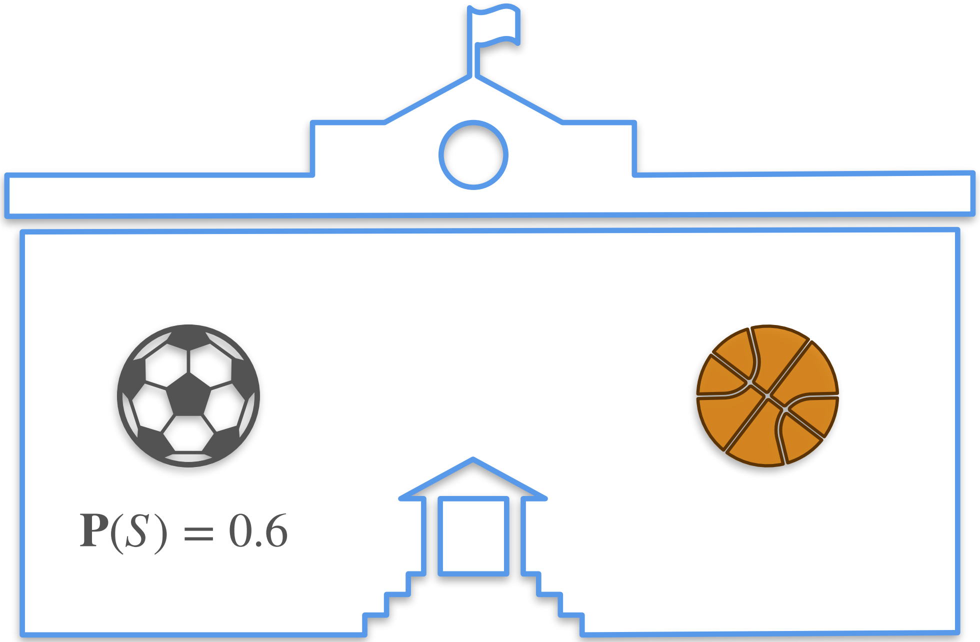
Sum of Probabilities (Joint Events): Quiz 3



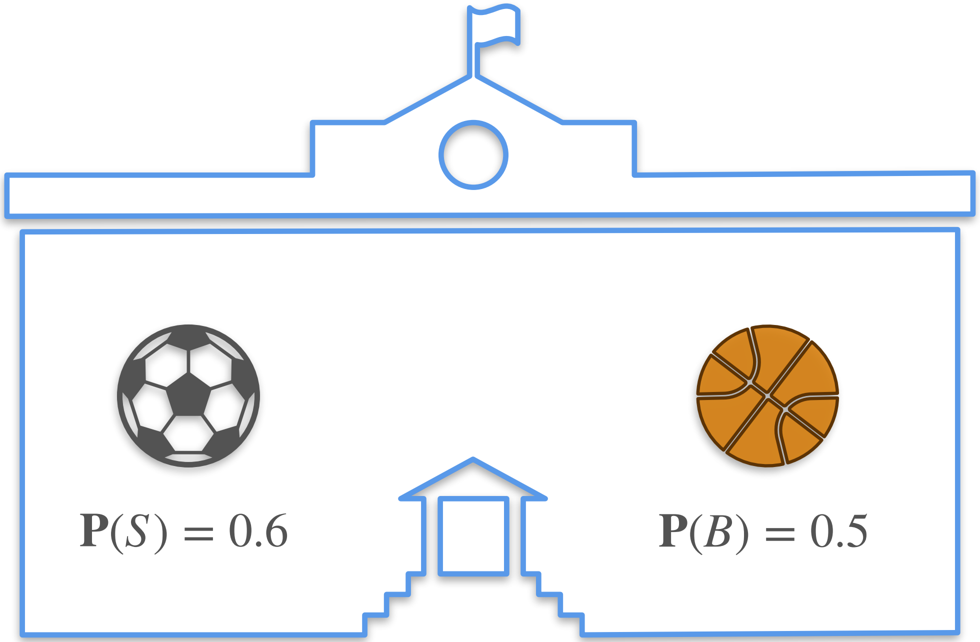
Sum of Probabilities (Joint Events): Quiz 3



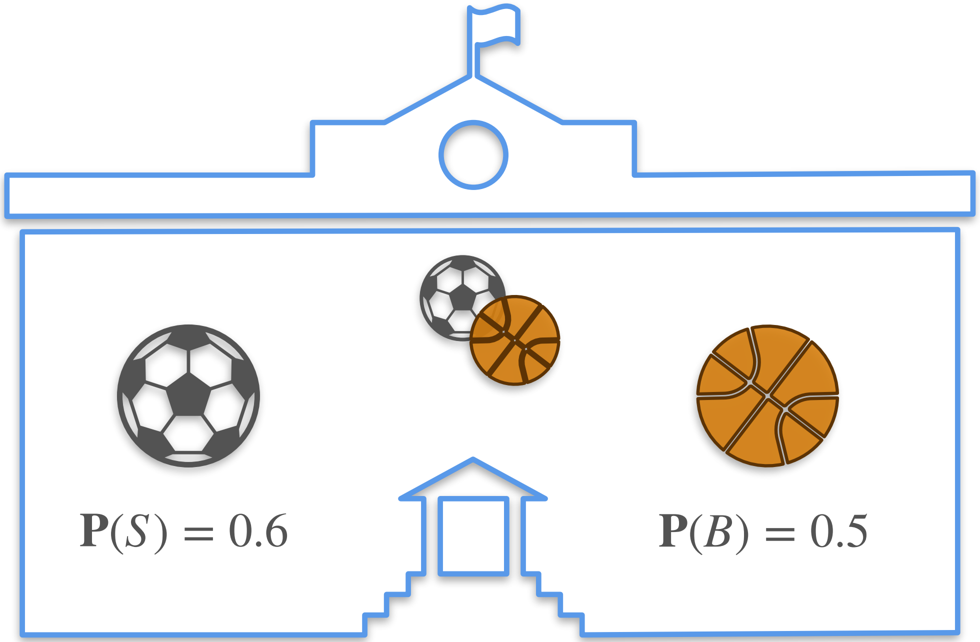
Sum of Probabilities (Joint Events): Quiz 3



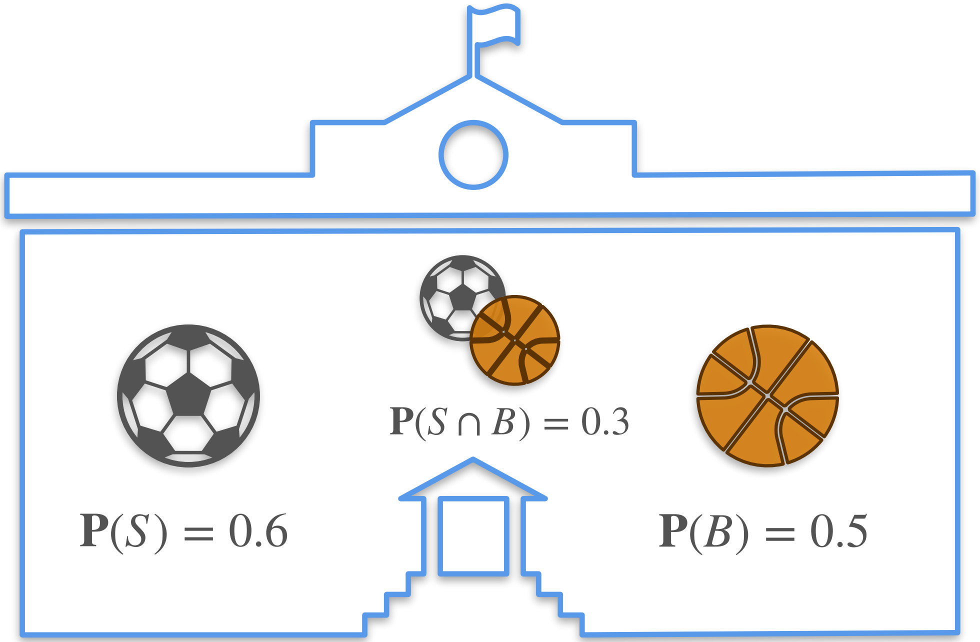
Sum of Probabilities (Joint Events): Quiz 3



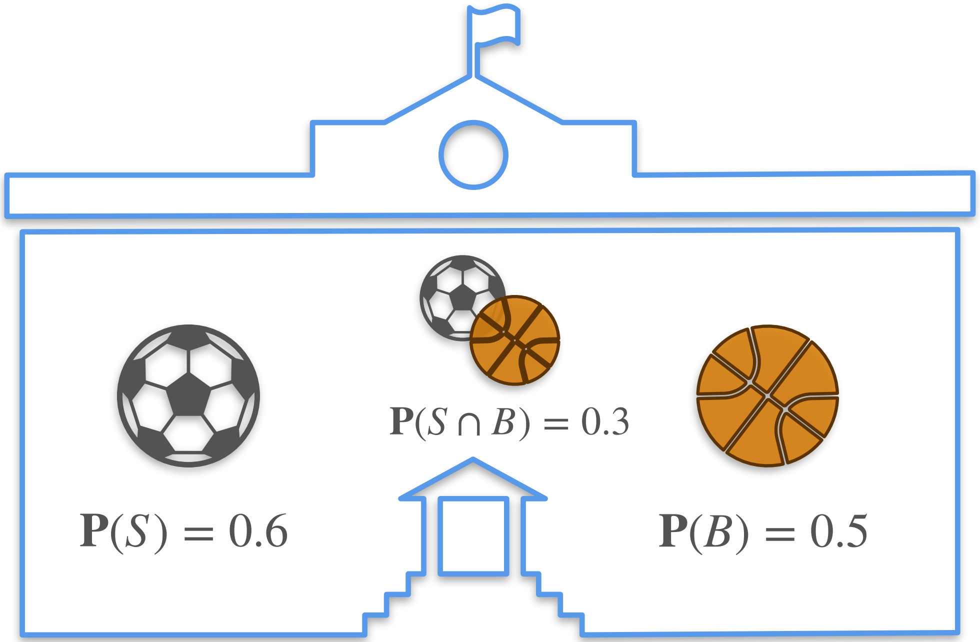
Sum of Probabilities (Joint Events): Quiz 3



Sum of Probabilities (Joint Events): Quiz 3



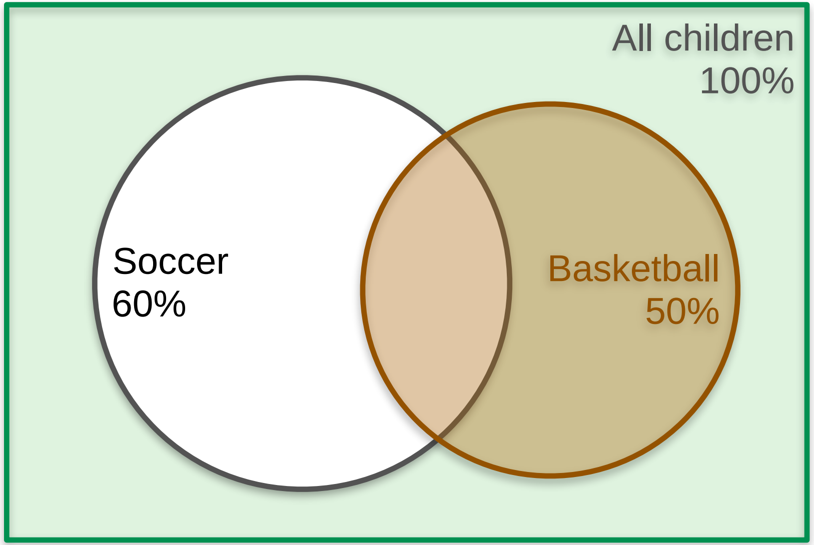
Sum of Probabilities (Joint Events): Quiz 3



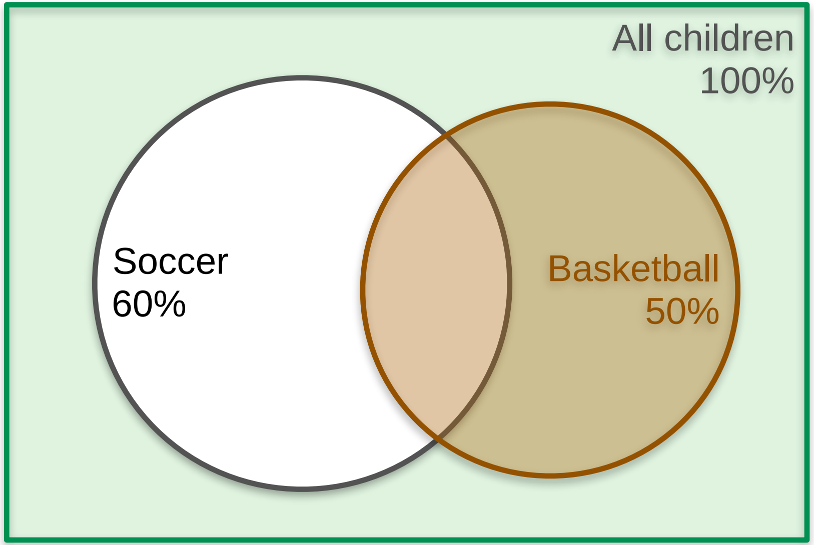
What is the probability that a child plays soccer or basketball?

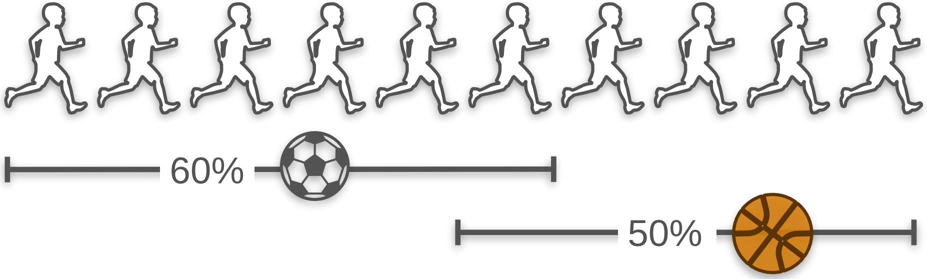
Sum of Probabilities (Joint Events): Quiz 3 Solution

Sum of Probabilities (Joint Events): Quiz 3 Solution

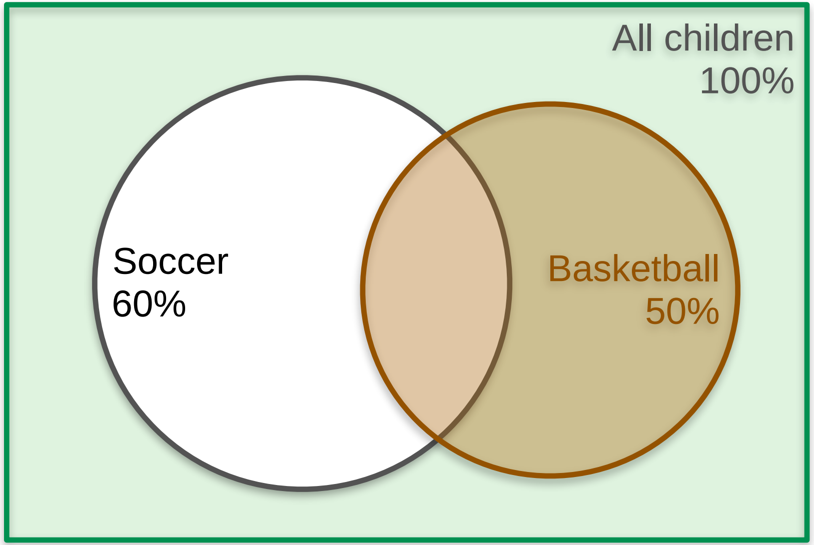


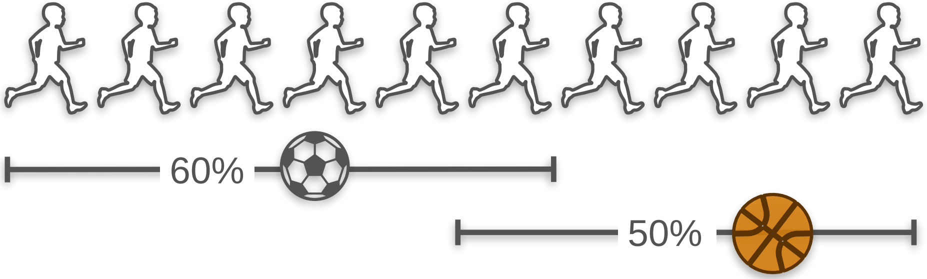
Sum of Probabilities (Joint Events): Quiz 3 Solution





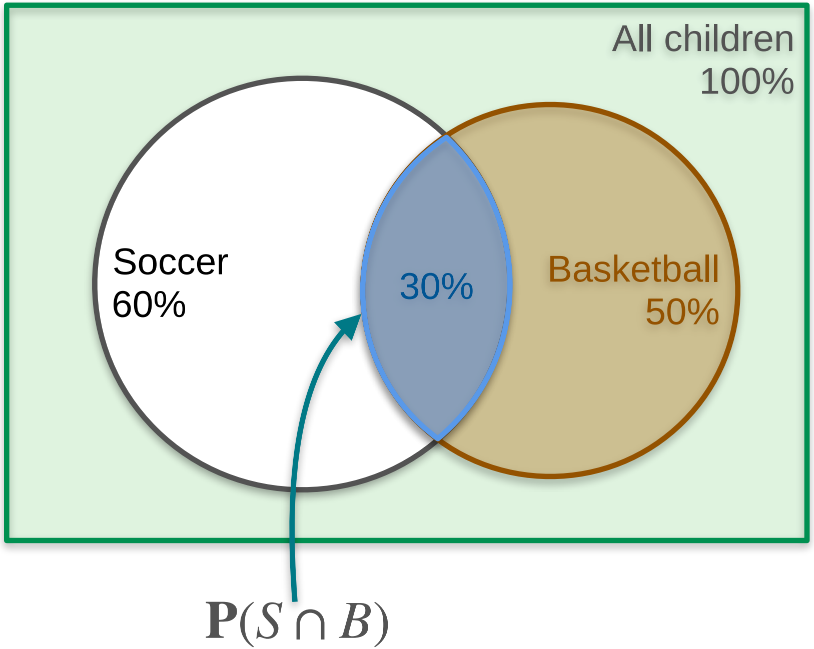
Sum of Probabilities (Joint Events): Quiz 3 Solution

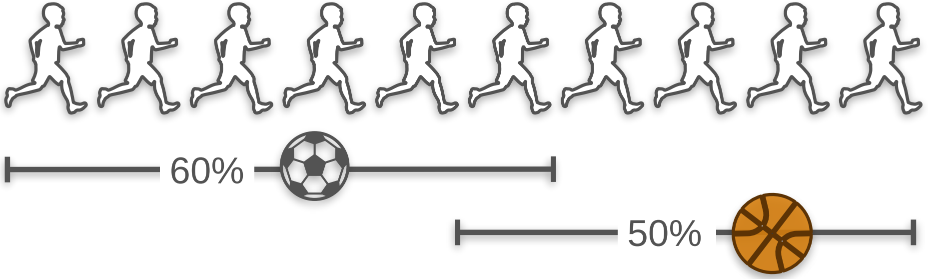




$$\mathbf{P}(S \cup B) = \mathbf{P}(S) + \mathbf{P}(B)$$

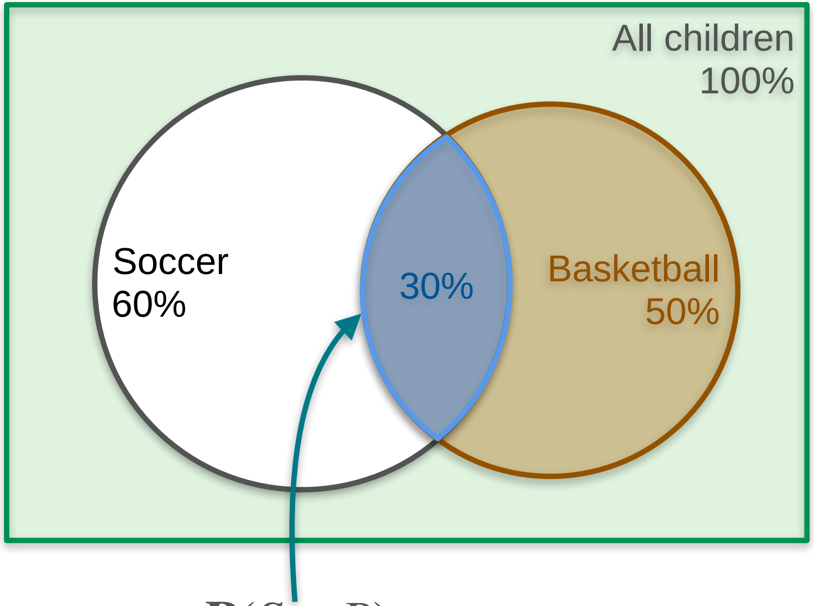
Sum of Probabilities (Joint Events): Quiz 3 Solution



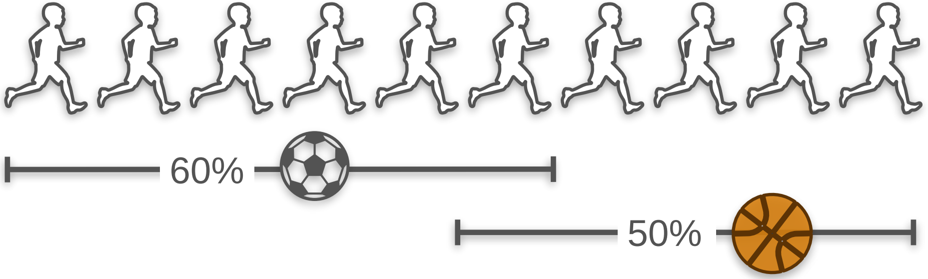


$$\mathbf{P}(S \cup B) = \mathbf{P}(S) + \mathbf{P}(B)$$

Sum of Probabilities (Joint Events): Quiz 3 Solution

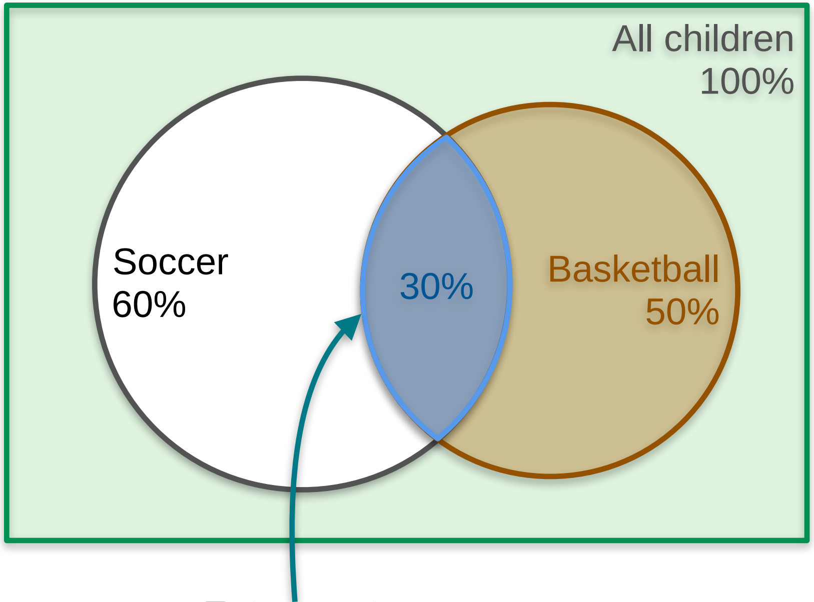


$\mathbf{P}(S \cap B)$

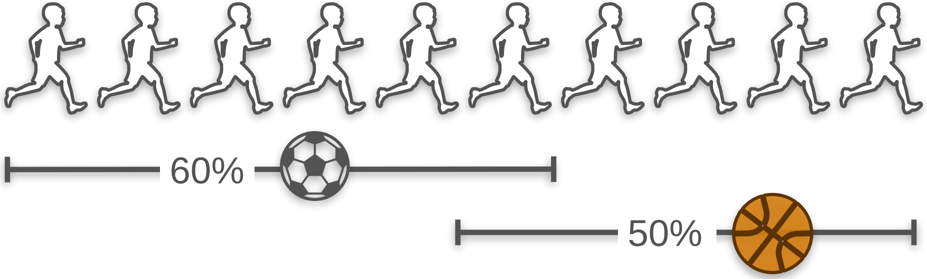


$$\mathbf{P}(S \cup B) = \mathbf{P}(S) + \mathbf{P}(B) - \mathbf{P}(S \cap B)$$

Sum of Probabilities (Joint Events): Quiz 3 Solution



$\mathbf{P}(S \cap B)$



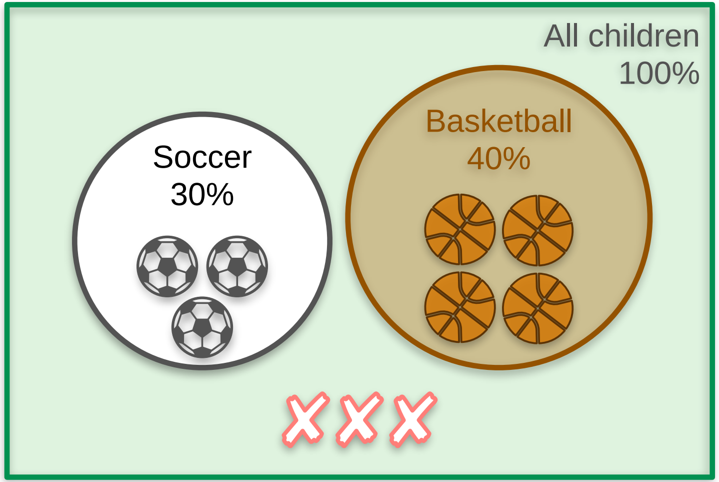
$$\mathbf{P}(S \cup B) = \mathbf{P}(S) + \mathbf{P}(B) - \mathbf{P}(S \cap B)$$

$$= 0.6 + 0.5 - 0.3$$

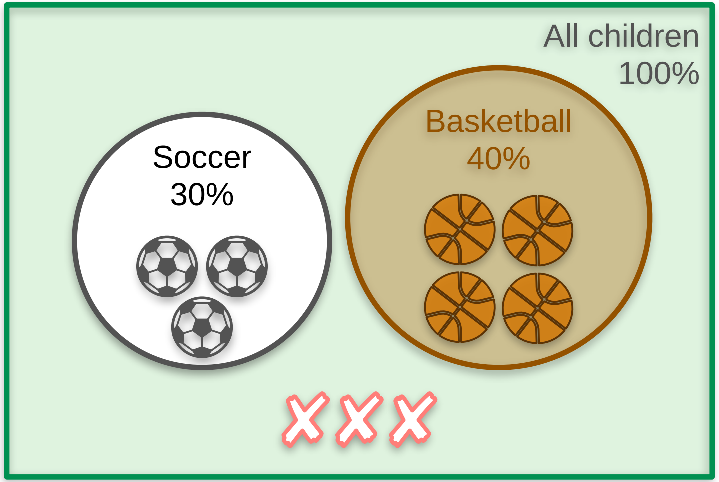
$$= 0.8$$

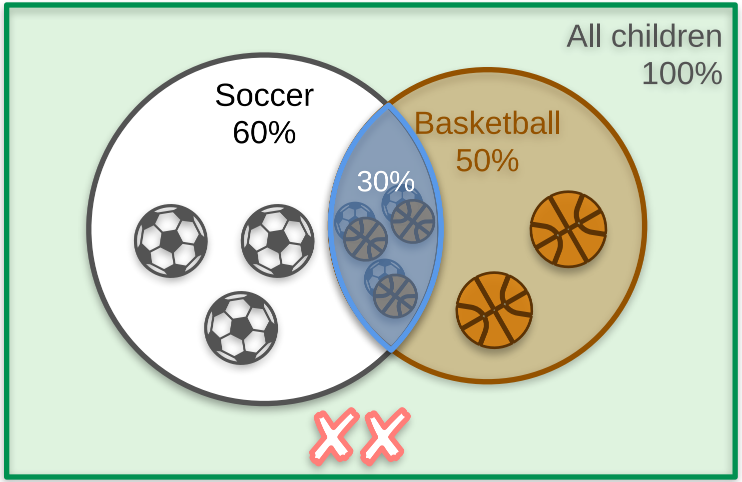
Disjoint Events Vs Joint Events

Disjoint Events Vs Joint Events

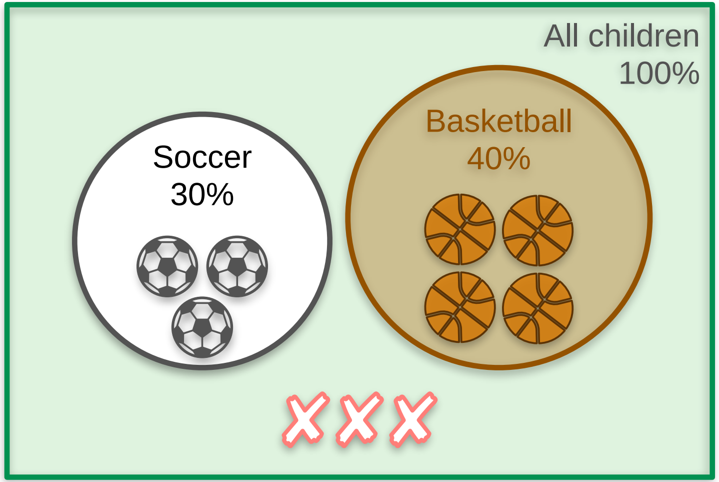


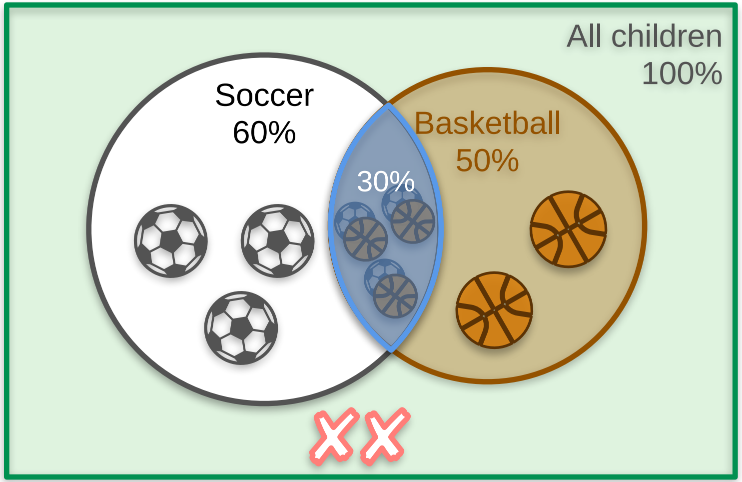
Disjoint Events Vs Joint Events





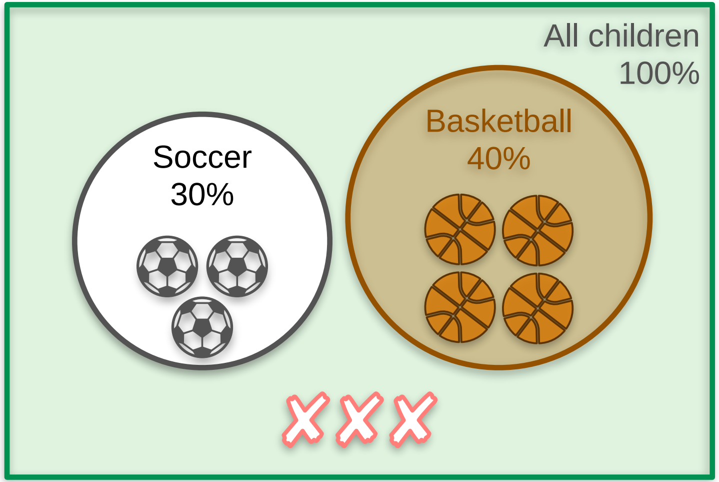
Disjoint Events Vs Joint Events

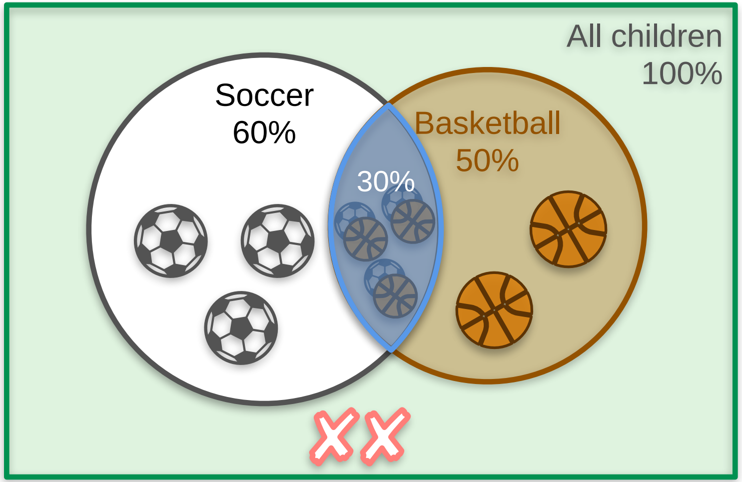




Disjoint Events Vs Joint Events

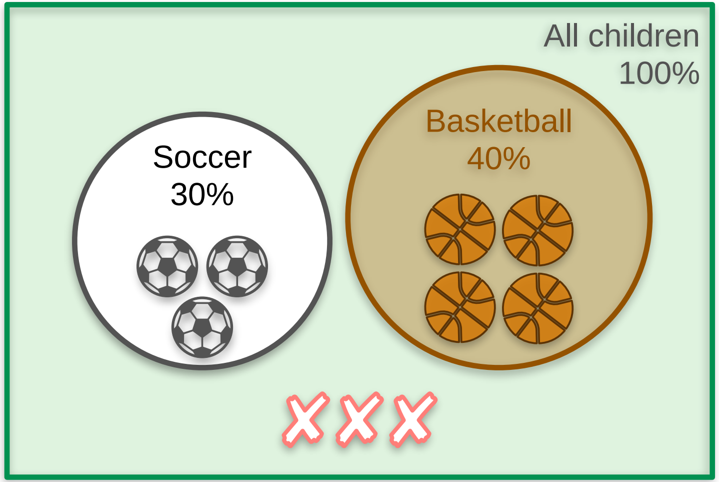
Disjoint



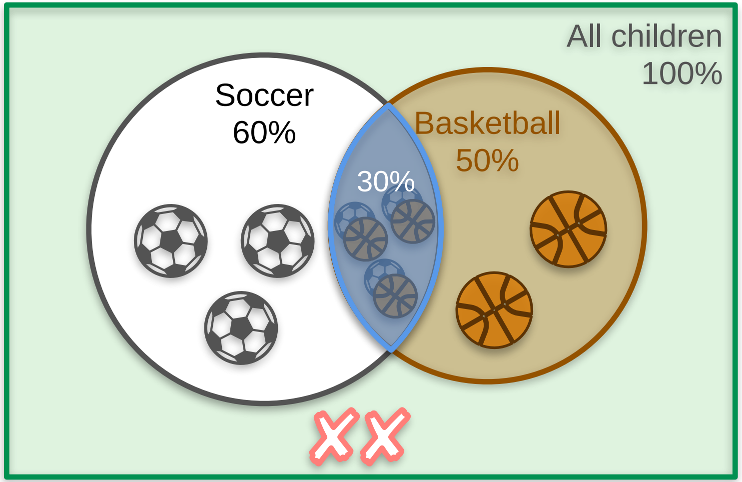


Disjoint Events Vs Joint Events

Disjoint

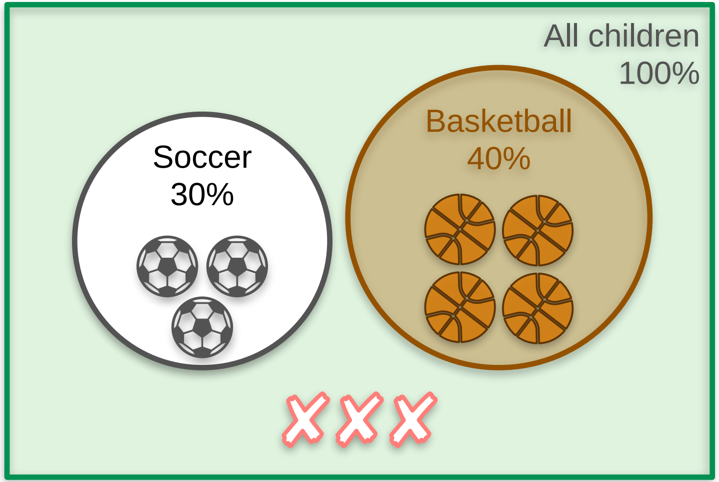


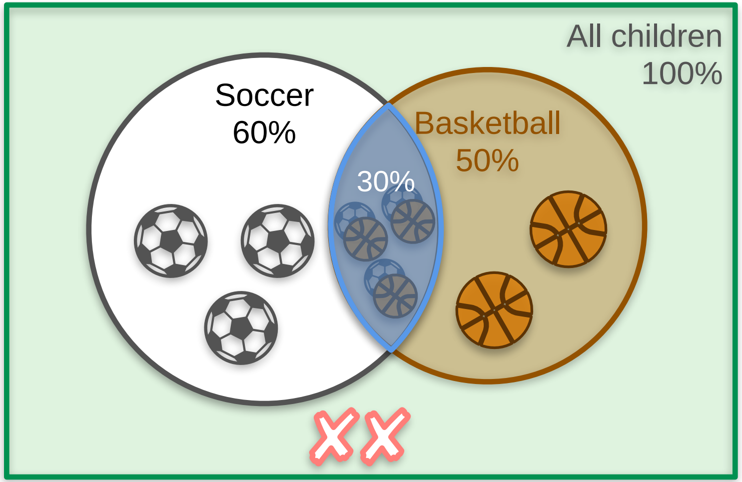
Mutually exclusive



Disjoint Events Vs Joint Events

Disjoint



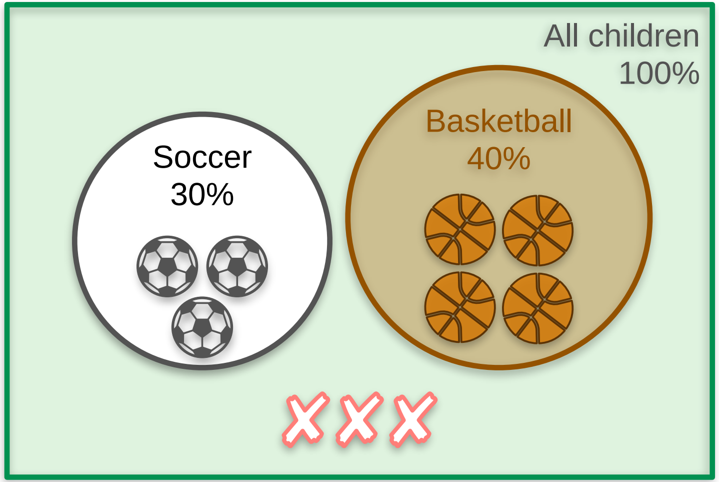


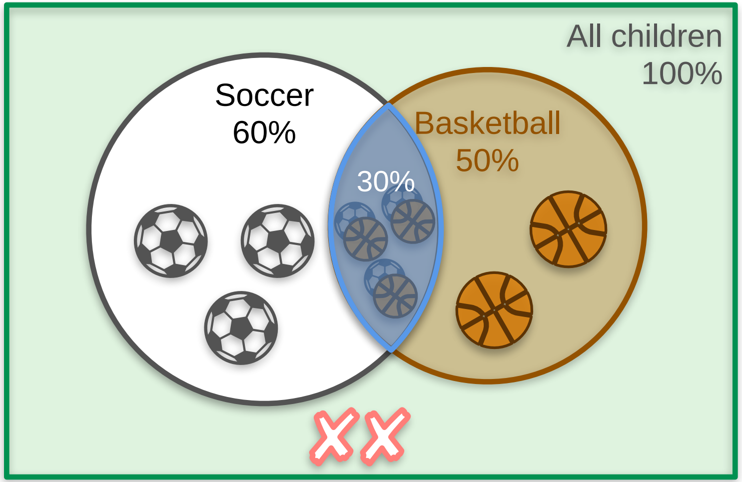
Mutually exclusive

$$\mathbf{P}(S \cup B) = \mathbf{P}(S) + \mathbf{P}(B)$$

Disjoint Events Vs Joint Events

Disjoint





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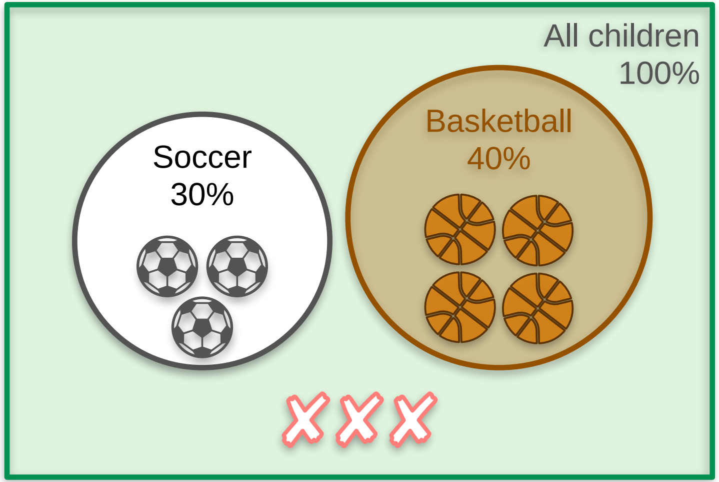
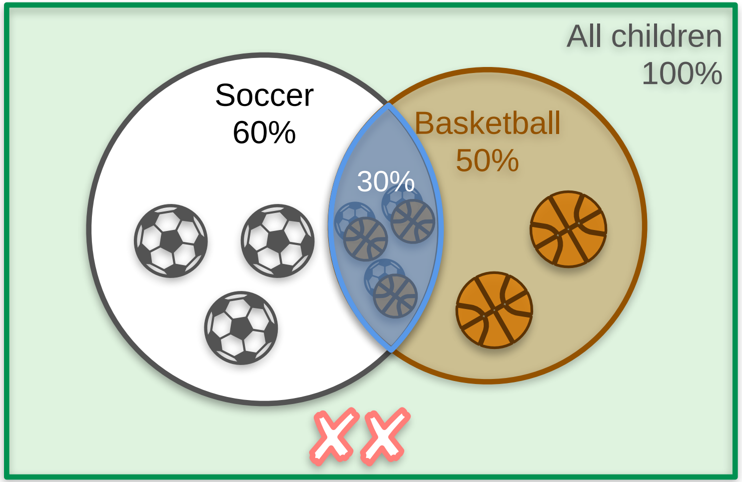
Disjoint Events Vs Joint Events

Disjoint





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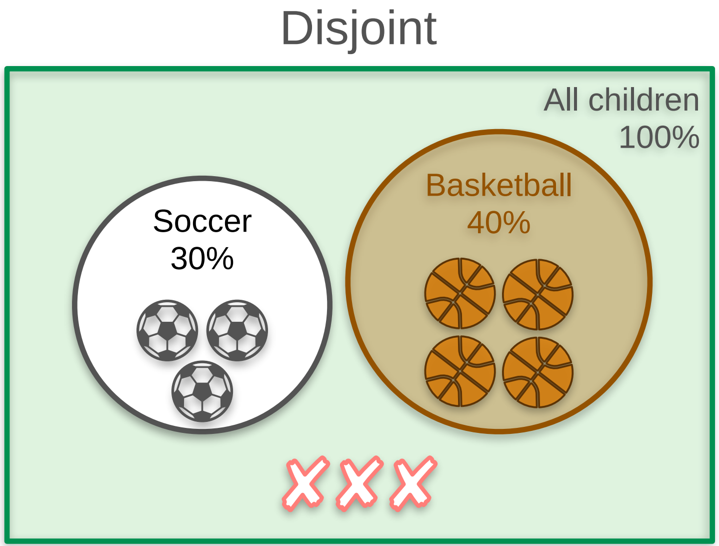
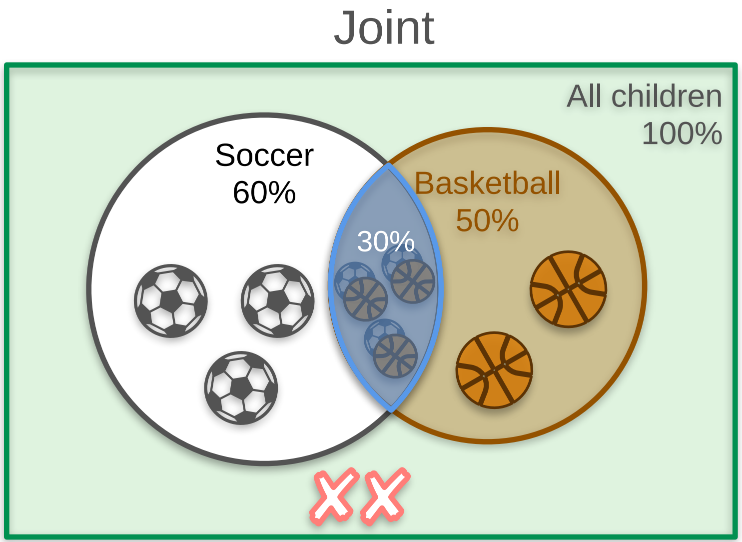
$$\mathbf{P}(S \cup B) = \mathbf{P}(S) + \mathbf{P}(B)$$

Disjoint Events Vs Joint Events



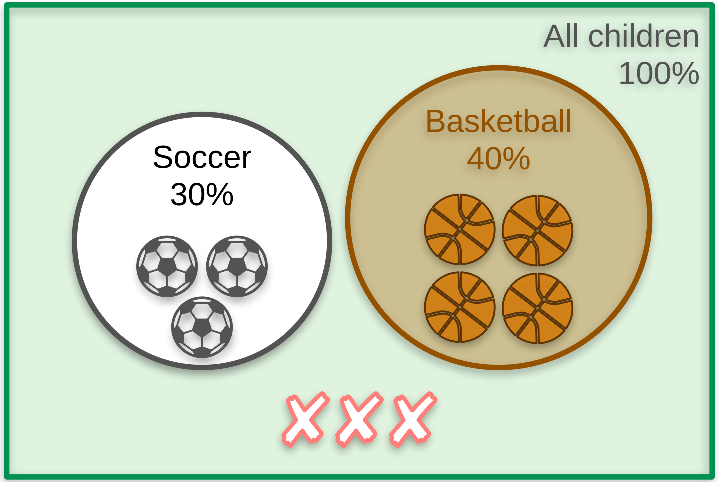
Mutually exclusive

$$\mathbf{P}(S \cup B) = \mathbf{P}(S) + \mathbf{P}(B)$$



Disjoint Events Vs Joint Events

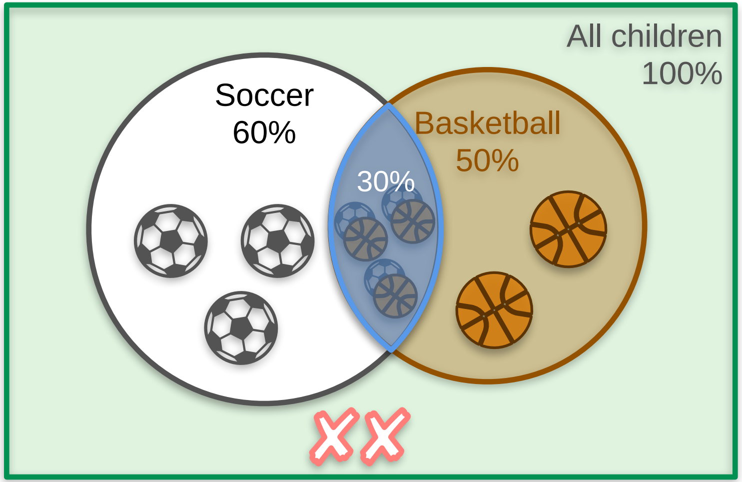
Disjoint



Mutually exclusive

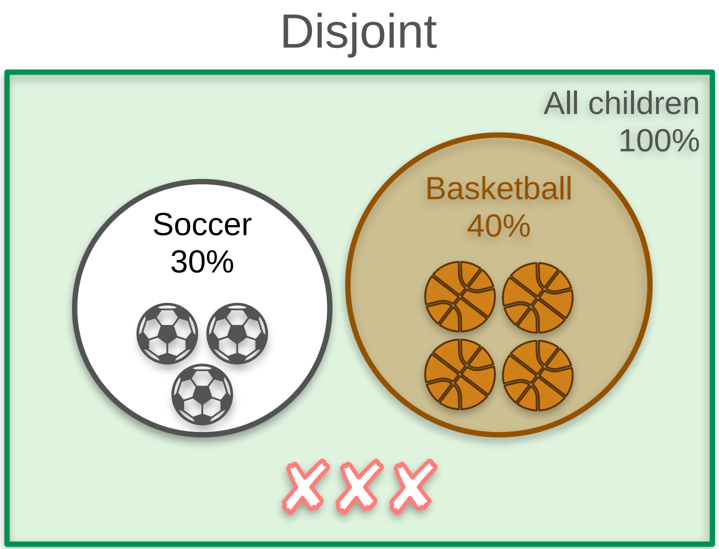
$$\mathbf{P}(S \cup B) = \mathbf{P}(S) + \mathbf{P}(B)$$

Joint



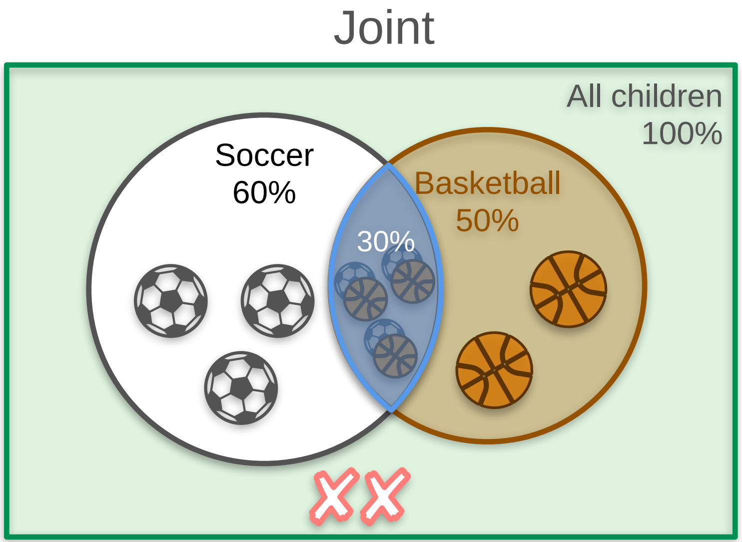
Non-mutually exclusive

Disjoint Events Vs Joint Events



Mutually exclusive

$$\mathbf{P}(S \cup B) = \mathbf{P}(S) + \mathbf{P}(B)$$

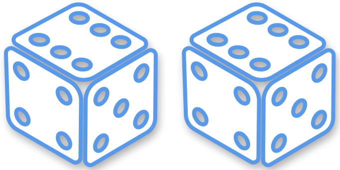


Non-mutually exclusive

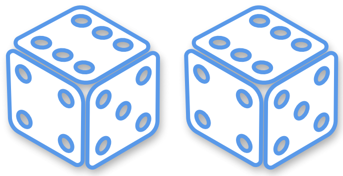
$$\mathbf{P}(S \cup B) = \mathbf{P}(S) + \mathbf{P}(B) - \mathbf{P}(S \cap B)$$

Sum of Probabilities (Joint Events): Dice Example 1

Sum of Probabilities (Joint Events): Dice Example 1



Sum of Probabilities (Joint Events): Dice Example 1



What is the probability of obtaining
a sum of 7 or a difference of 1?

Sum of Probabilities (Joint Events): Dice Example 1

Sum of Probabilities (Joint Events): Dice Example 1

sum = 7

diff = 1

Sum of Probabilities (Joint Events): Dice Example 1

sum = 7

diff = 1

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

Sum of Probabilities (Joint Events): Dice Example 1

sum = 7

diff = 1

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

Sum of Probabilities (Joint Events): Dice Example 1

sum = 7

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

diff = 1

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

Sum of Probabilities (Joint Events): Dice Example 1

sum = 7

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

diff = 1

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

Sum of Probabilities (Joint Events): Dice Example 1

A

sum = 7

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

B

diff = 1

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

Sum of Probabilities (Joint Events): Dice Example 1

A or B

sum = 7 or diff = 1

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

Sum of Probabilities (Joint Events): Dice Example 1

A or B

sum = 7 or diff = 1

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

sum = 7 and diff = 1

Sum of Probabilities (Joint Events): Dice Example 1

	1,1	1,2	1,3	1,4	1,5	1,6
	2,1	2,2	2,3	2,4	2,5	2,6
	3,1	3,2	3,3	3,4	3,5	3,6
	4,1	4,2	4,3	4,4	4,5	4,6
	5,1	5,2	5,3	5,4	5,5	5,6
	6,1	6,2	6,3	6,4	6,5	6,6

Sum of Probabilities (Joint Events): Dice Example 1

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$\mathbf{P}(\text{sum} = 7 \text{ or diff} = 1)$

Sum of Probabilities (Joint Events): Dice Example 1

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$\mathbf{P}(\text{sum} = 7 \text{ or diff} = 1)$

$= \frac{}{}$

Sum of Probabilities (Joint Events): Dice Example 1

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$\mathbf{P}(\text{sum} = 7 \text{ or diff} = 1)$

6,1 5,2 4,3 3,4 2,5 1,6

$= \overline{}$

Sum of Probabilities (Joint Events): Dice Example 1

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$\mathbf{P}(\text{sum} = 7 \text{ or diff} = 1)$

1,6
2,5
3,4
4,3
5,2
6,1

$=$ ─────────────

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

Sum of Probabilities (Joint Events): Dice Example 1

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$\mathbf{P}(\text{sum} = 7 \text{ or diff} = 1)$

1,6
2,5
3,4
4,3
5,2
6,1

$= \frac{\quad}{\quad} + \frac{\quad}{\quad}$

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

Sum of Probabilities (Joint Events): Dice Example 1

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$\mathbf{P}$(sum = 7 or diff = 1)

1,6 2,5 3,4 4,3 5,2 6,1

=

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

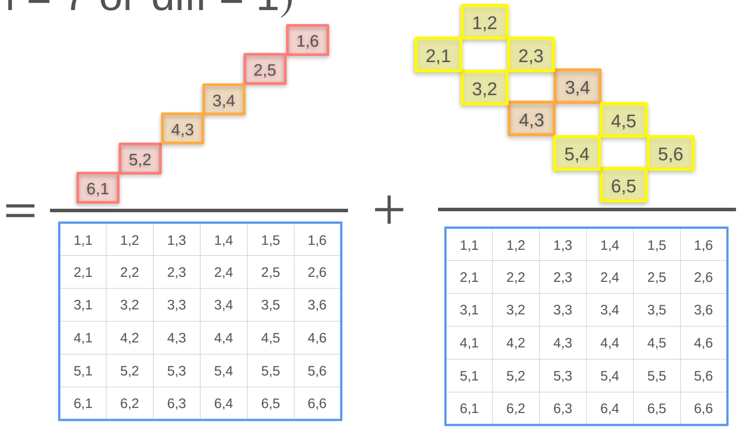
+

1,2 2,1 2,3 3,2 3,4 4,3 4,5 5,4 5,6 6,5

Sum of Probabilities (Joint Events): Dice Example 1

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$\mathbf{P}$(sum = 7 or diff = 1)

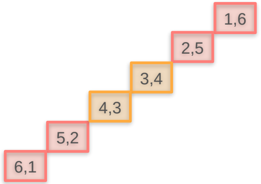


Sum of Probabilities (Joint Events): Dice Example 1

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

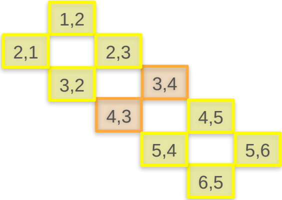
P(sum = 7 or diff = 1)

=



1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

+



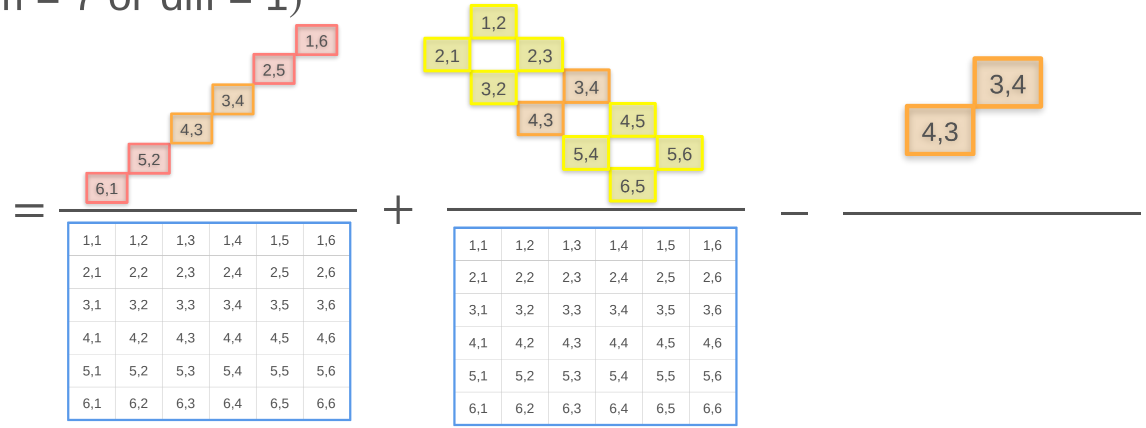
1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

−

Sum of Probabilities (Joint Events): Dice Example 1

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$\mathbf{P}(\text{sum} = 7 \text{ or diff} = 1)$



Sum of Probabilities (Joint Events): Dice Example 1

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$\mathbf{P}(\text{sum} = 7 \text{ or diff} = 1)$

=

1,6
2,5
3,4
4,3
5,2
6,1

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

+

1,2
2,1 2,3
3,2 3,4
4,3 4,5
5,4 5,6
6,5

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

−

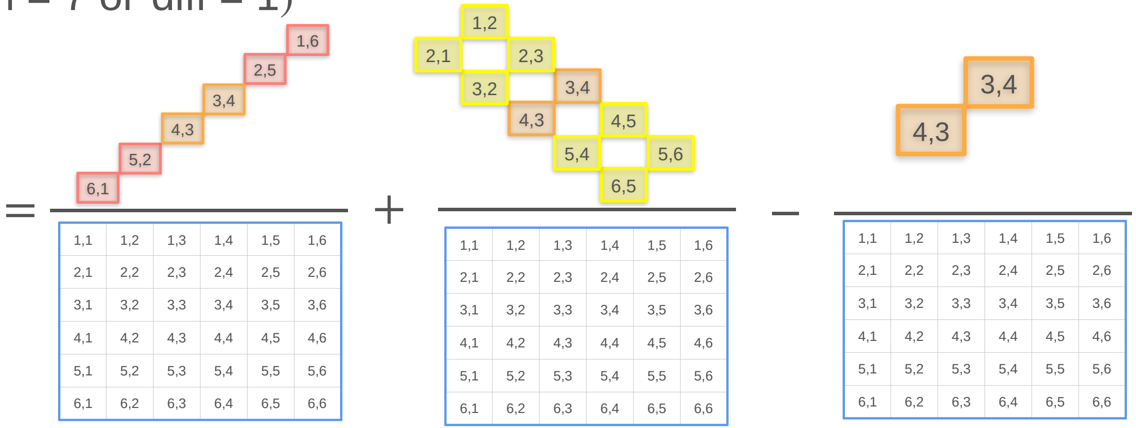
3,4
4,3

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

Sum of Probabilities (Joint Events): Dice Example 1

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

P(sum = 7 or diff = 1)

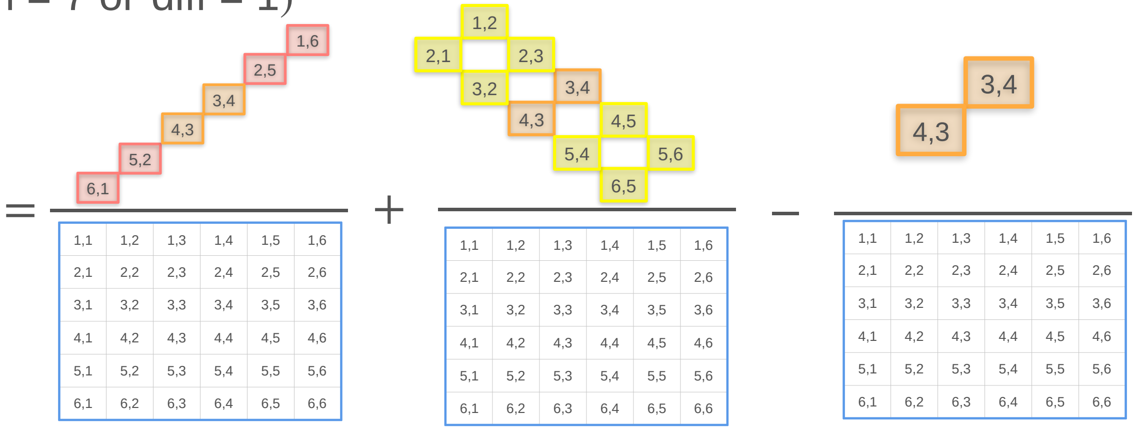


$$= \frac{6}{36}$$

Sum of Probabilities (Joint Events): Dice Example 1

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$\mathbf{P}$(sum = 7 or diff = 1)



$$= \frac{6}{36} + \frac{10}{36}$$

Sum of Probabilities (Joint Events): Dice Example 1

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$\mathbf{P}(\text{sum} = 7 \text{ or diff} = 1)$

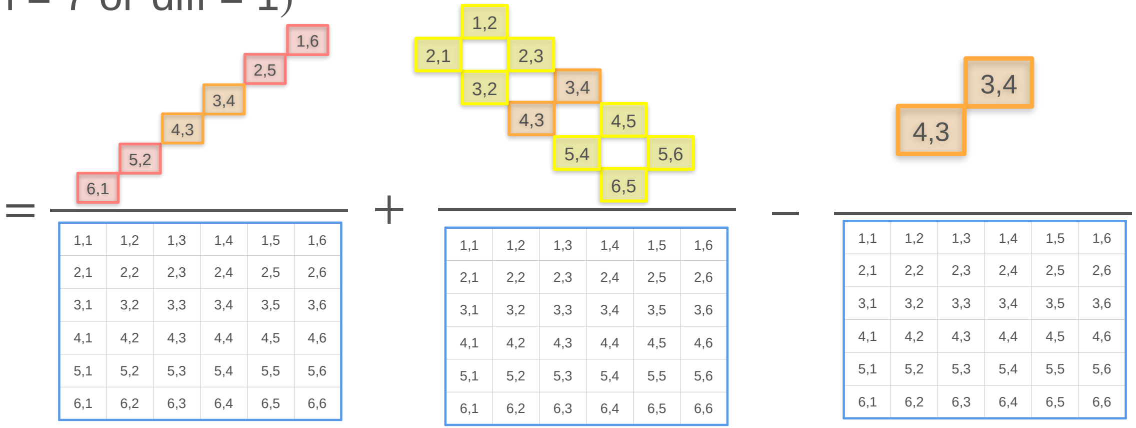
$= \dfrac{\{1,6;\ 2,5;\ 3,4;\ 4,3;\ 5,2;\ 6,1\}}{\text{all 36 outcomes}} + \dfrac{\{1,2;\ 2,1;\ 2,3;\ 3,2;\ 3,4;\ 4,3;\ 4,5;\ 5,4;\ 5,6;\ 6,5\}}{\text{all 36 outcomes}} - \dfrac{\{3,4;\ 4,3\}}{\text{all 36 outcomes}}$

$$= \frac{6}{36} + \frac{10}{36} - \frac{2}{36}$$

Sum of Probabilities (Joint Events): Dice Example 1

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

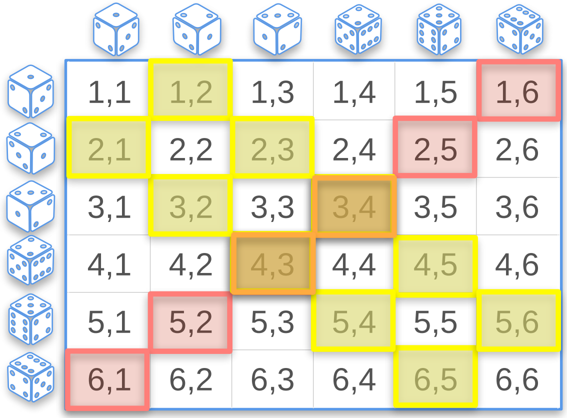
$\mathbf{P}(\text{sum} = 7 \text{ or diff} = 1)$



$$= \frac{6}{36} + \frac{10}{36} - \frac{2}{36}$$

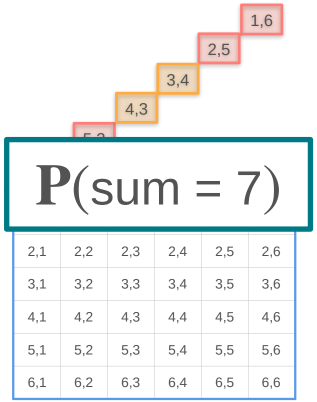
$$= \frac{14}{36}$$

Sum of Probabilities (Joint Events): Dice Example 1

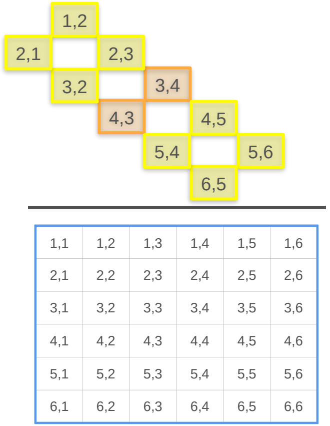


$\mathbf{P}(\text{sum} = 7 \text{ or diff} = 1)$

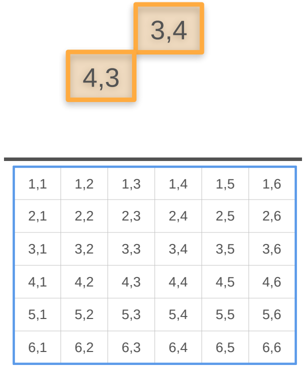
$=$ $\boxed{\mathbf{P}(\text{sum} = 7)}$



$+$



$-$



$$= \frac{6}{36} + \frac{10}{36} - \frac{2}{36}$$

$$= \frac{14}{36}$$

Sum of Probabilities (Joint Events): Dice Example 1

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$\mathbf{P}(\text{sum} = 7 \text{ or diff} = 1)$

1,6 2,5 3,4 4,3

1,2 2,1 2,3 3,2 3,4 4,3 4,5

3,4 4,3

$$= \boxed{\mathbf{P}(\text{sum} = 7)} + \boxed{\mathbf{P}(\text{diff} = 1)} - \_\_\_\_\_$$

2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$$= \frac{6}{36} + \frac{10}{36} - \frac{2}{36}$$

$$= \frac{14}{36}$$

Sum of Probabilities (Joint Events): Dice Example 1

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$\mathbf{P}(\text{sum} = 7 \text{ or diff} = 1)$

1,6 2,5 3,4 4,3

1,2 2,1 2,3 3,2 3,4 4,3 4,5

3,4 4,3

$$= \boxed{\mathbf{P}(\text{sum} = 7)} + \boxed{\mathbf{P}(\text{diff} = 1)} - \boxed{\mathbf{P}(\text{sum} = 7 \cap \text{diff} = 1)}$$

2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$$= \frac{6}{36} + \frac{10}{36} - \frac{2}{36}$$

$$= \frac{14}{36}$$

DeepLearning.AI

Introduction to probability

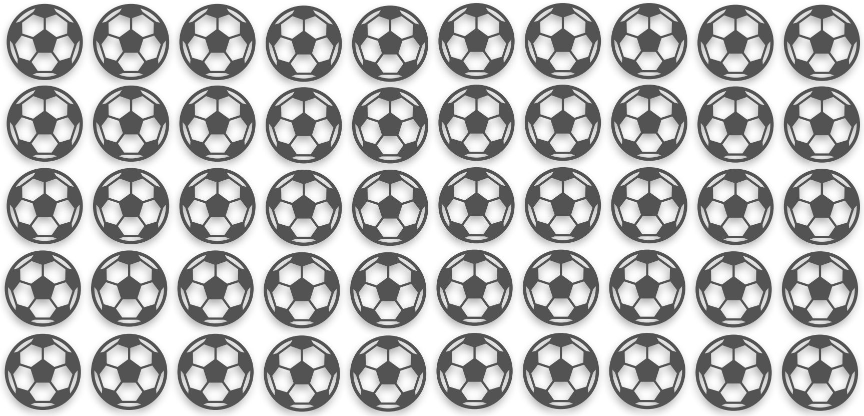
Independence

Independence: Quiz 1

Independence: Quiz 1

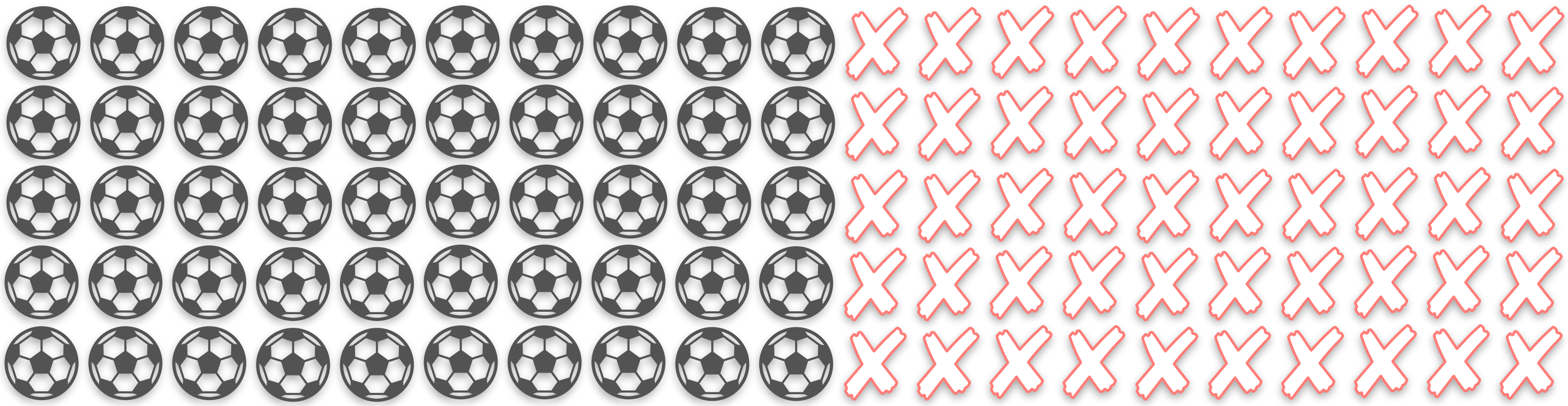
100 kids

Independence: Quiz 1



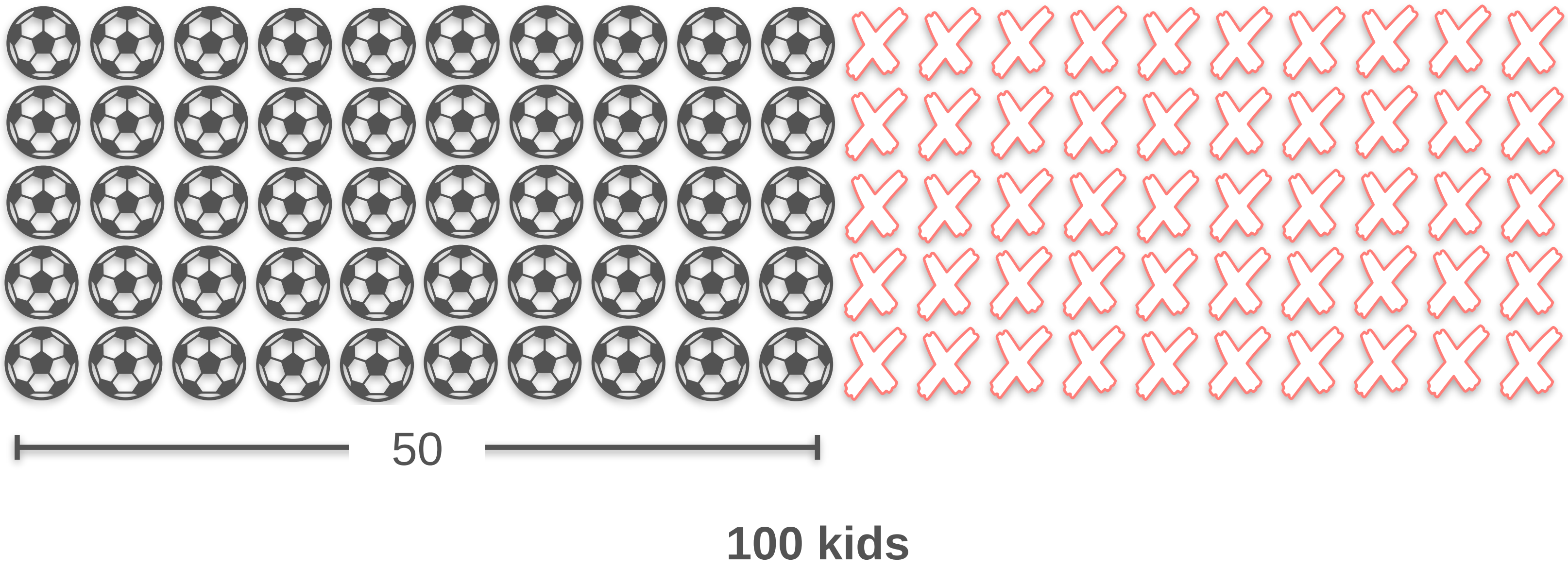
100 kids

Independence: Quiz 1

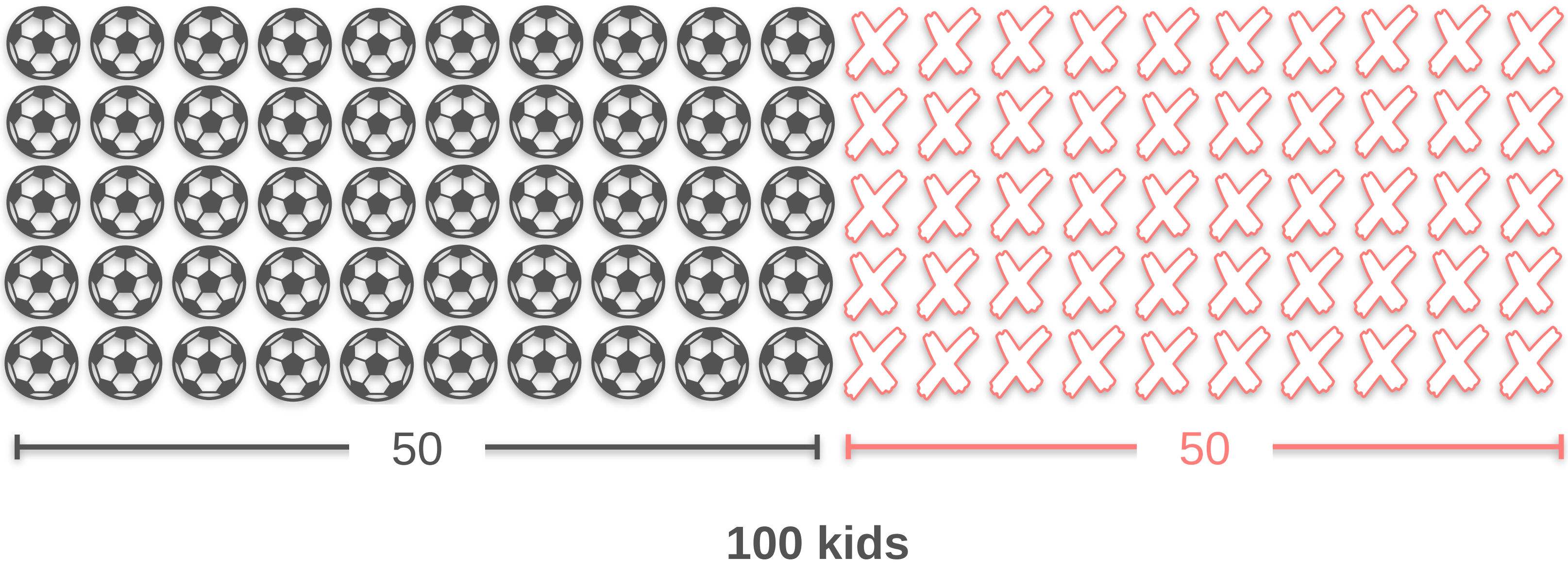


100 kids

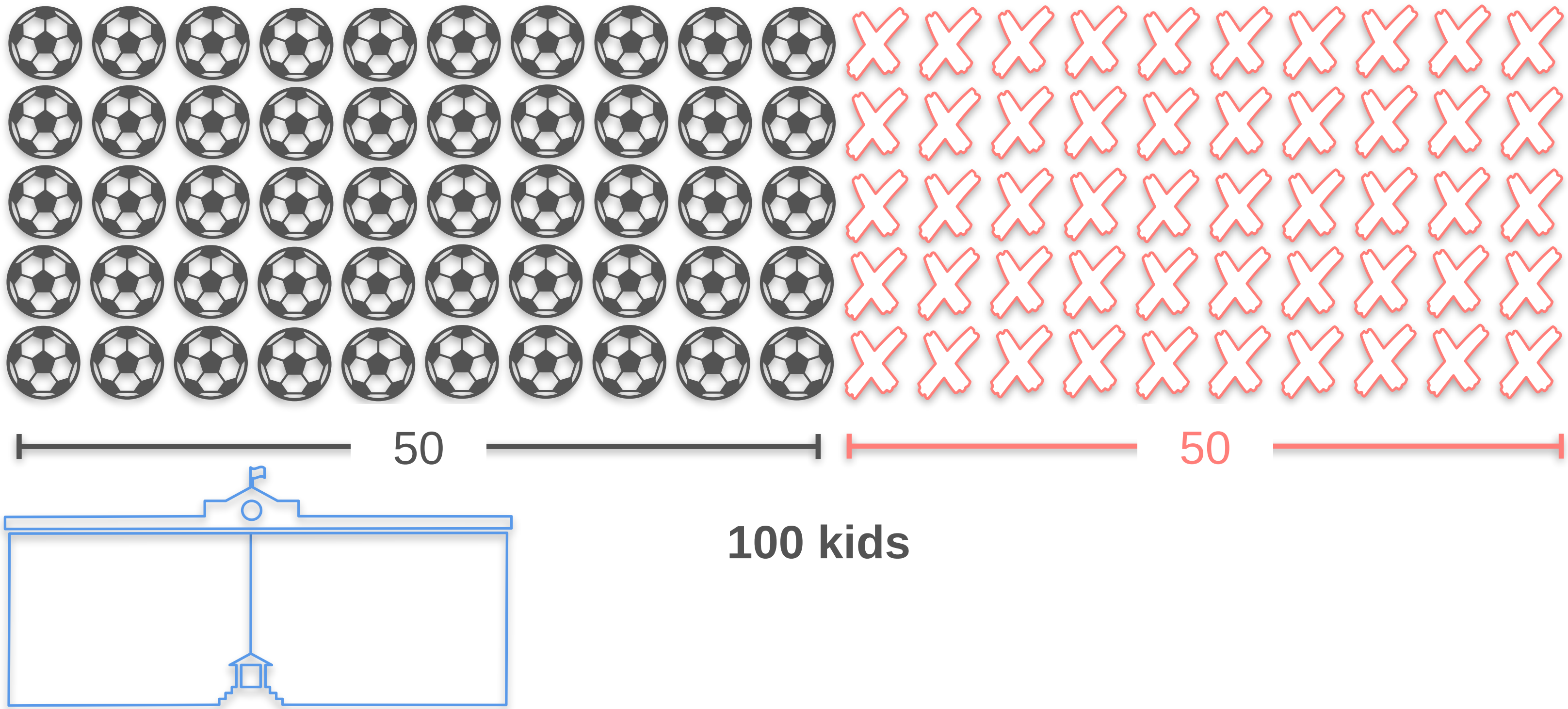
Independence: Quiz 1



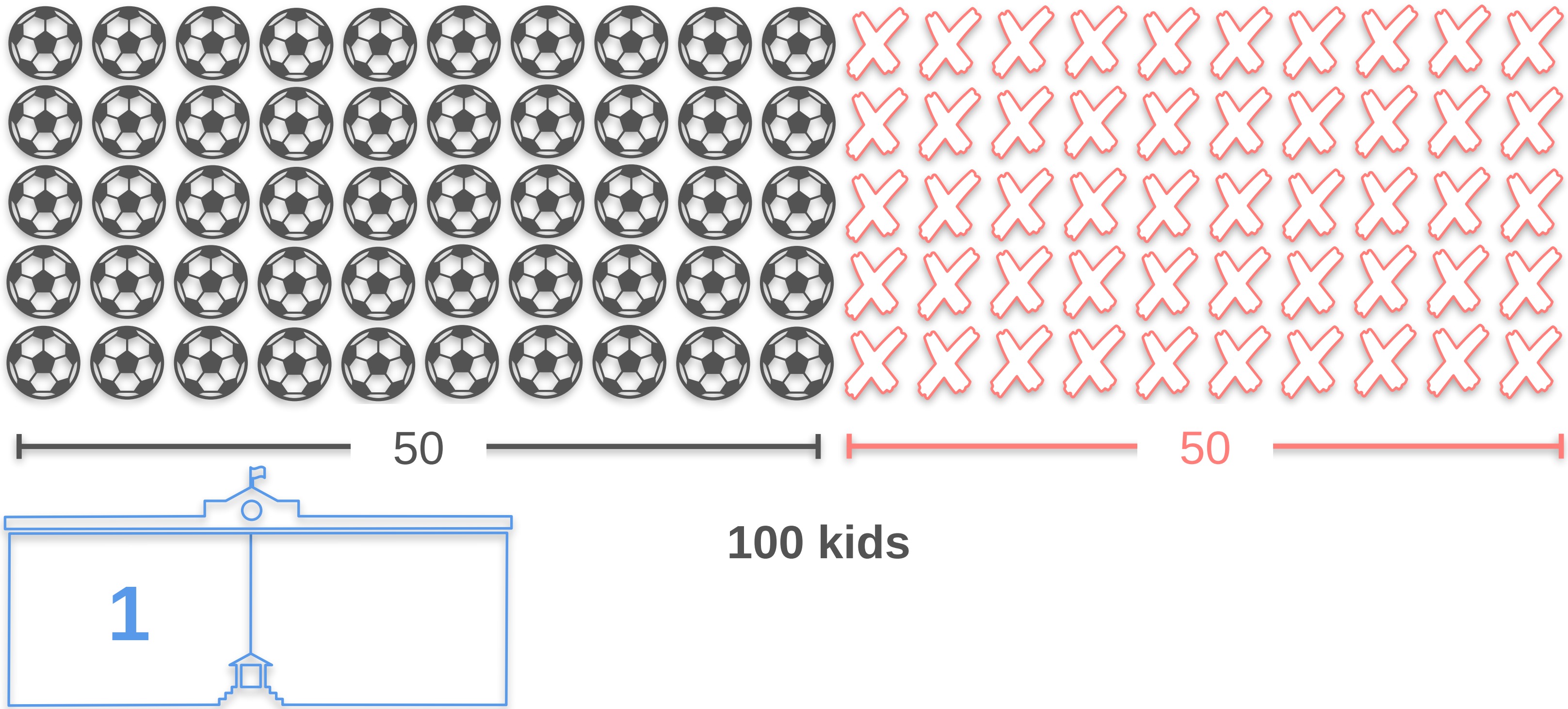
Independence: Quiz 1



Independence: Quiz 1

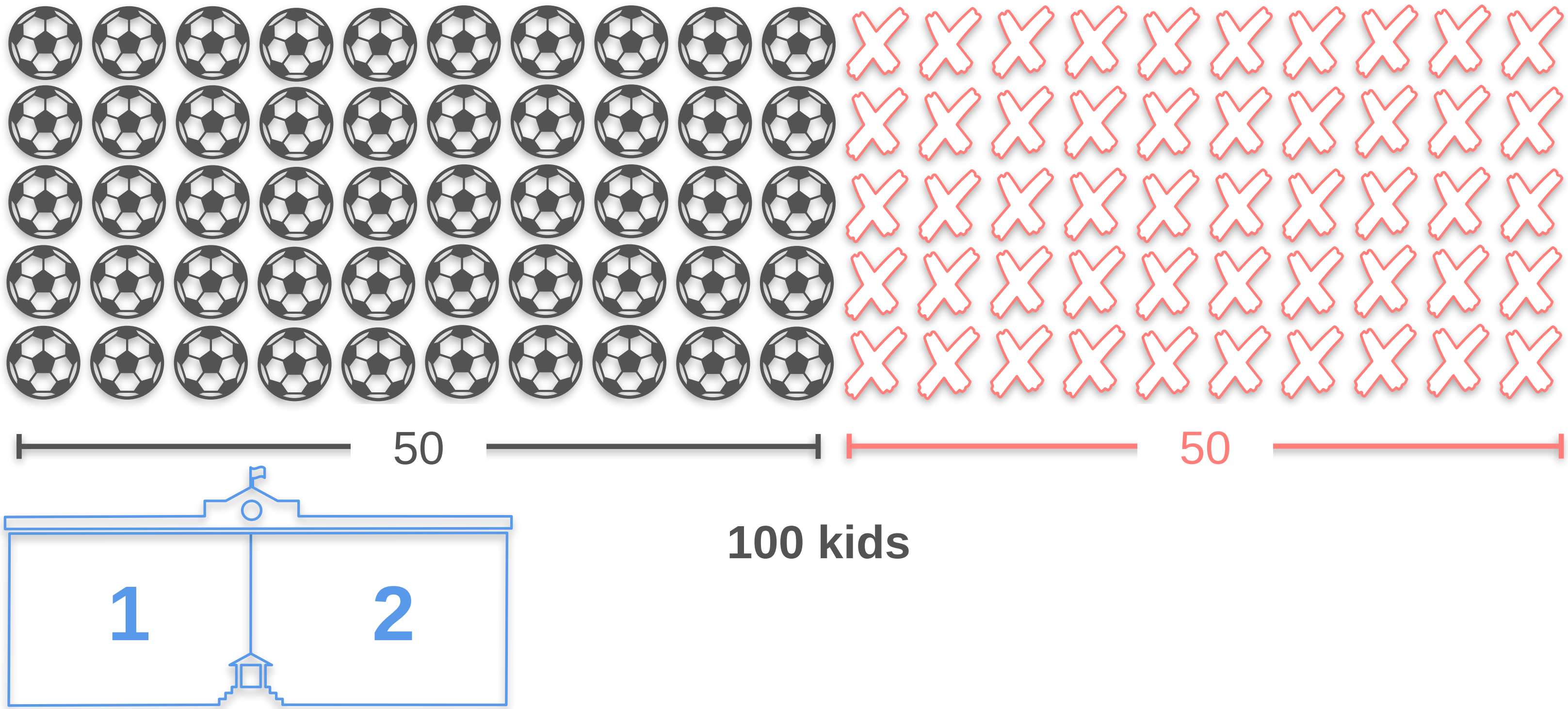


Independence: Quiz 1



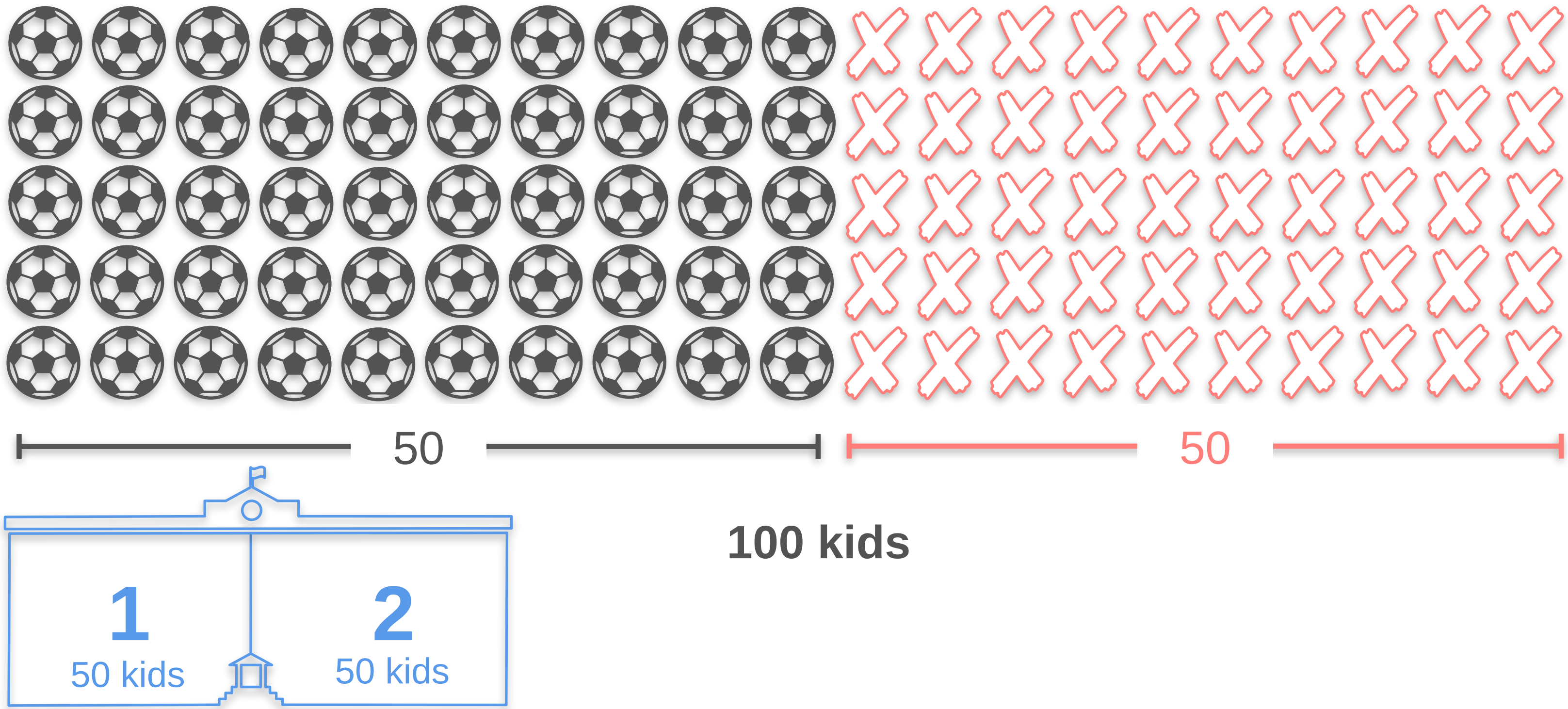
100 kids

Independence: Quiz 1

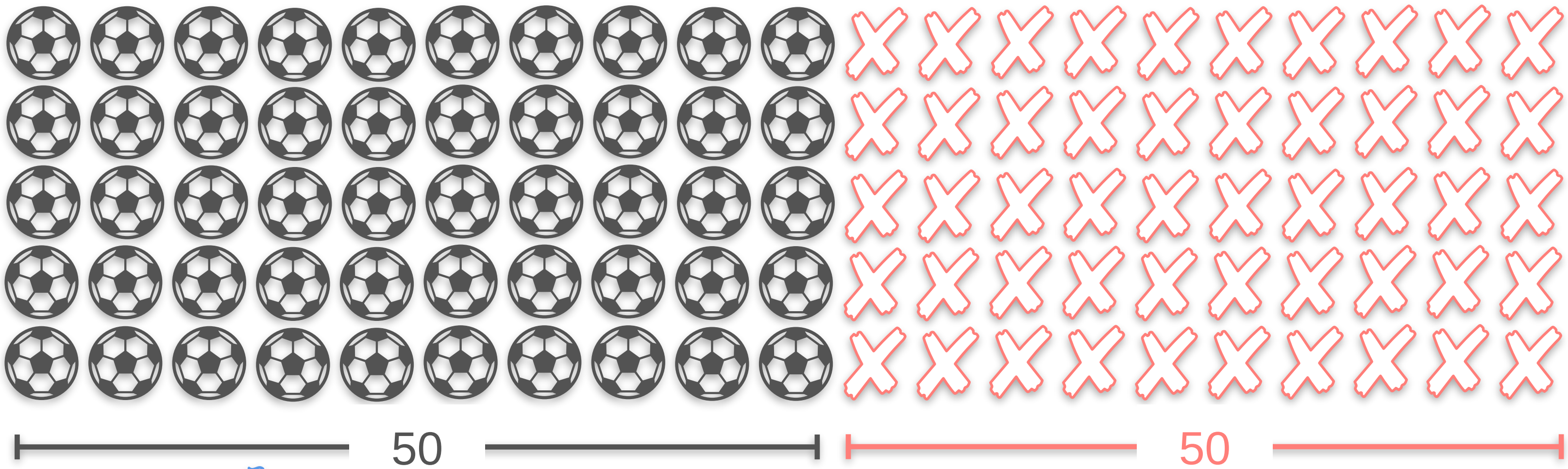


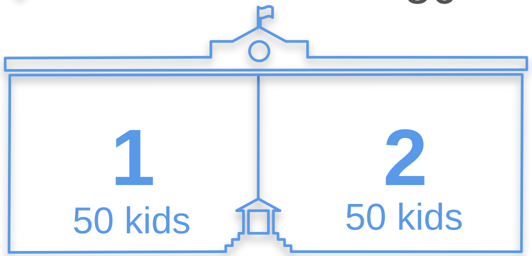
100 kids

Independence: Quiz 1



Independence: Quiz 1

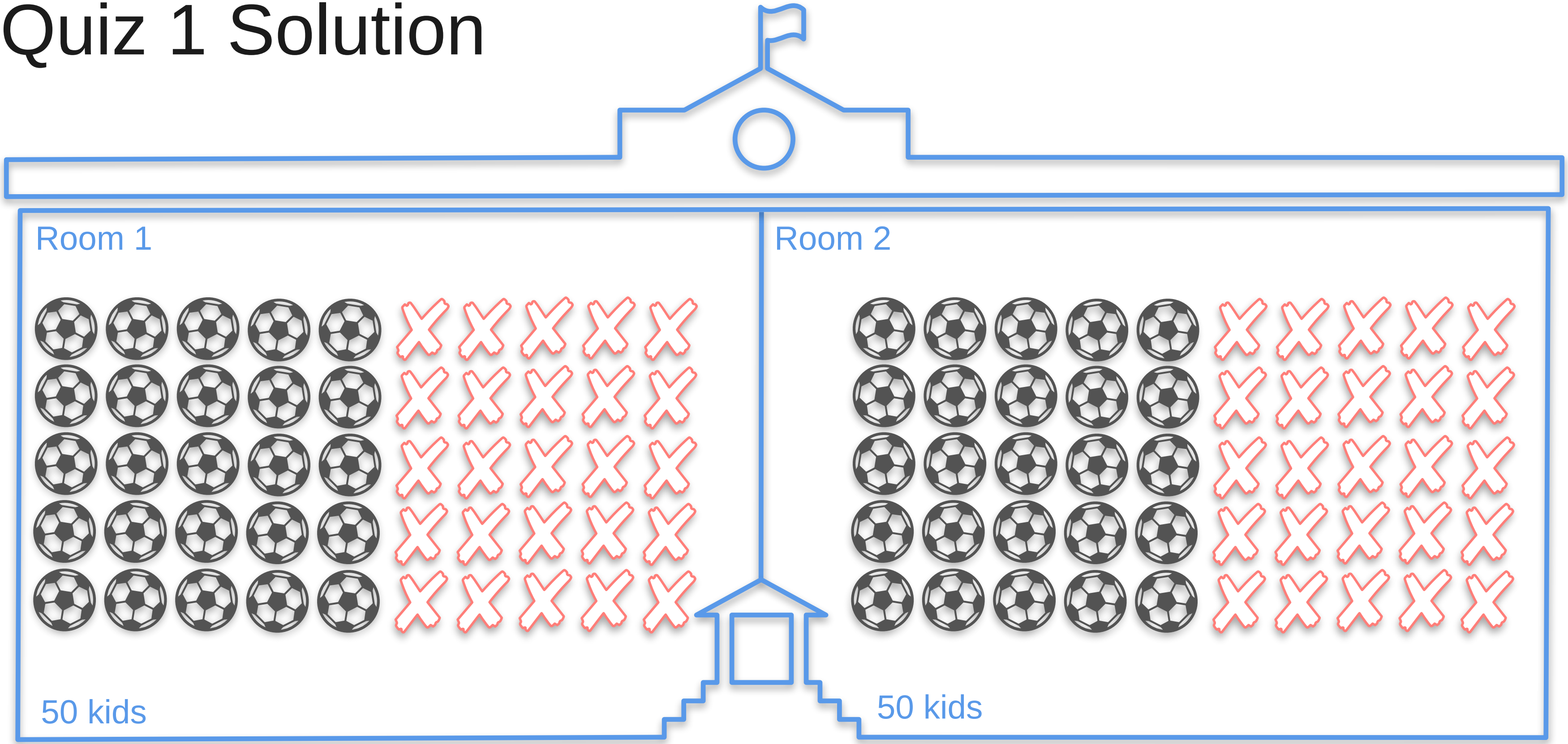




100 kids

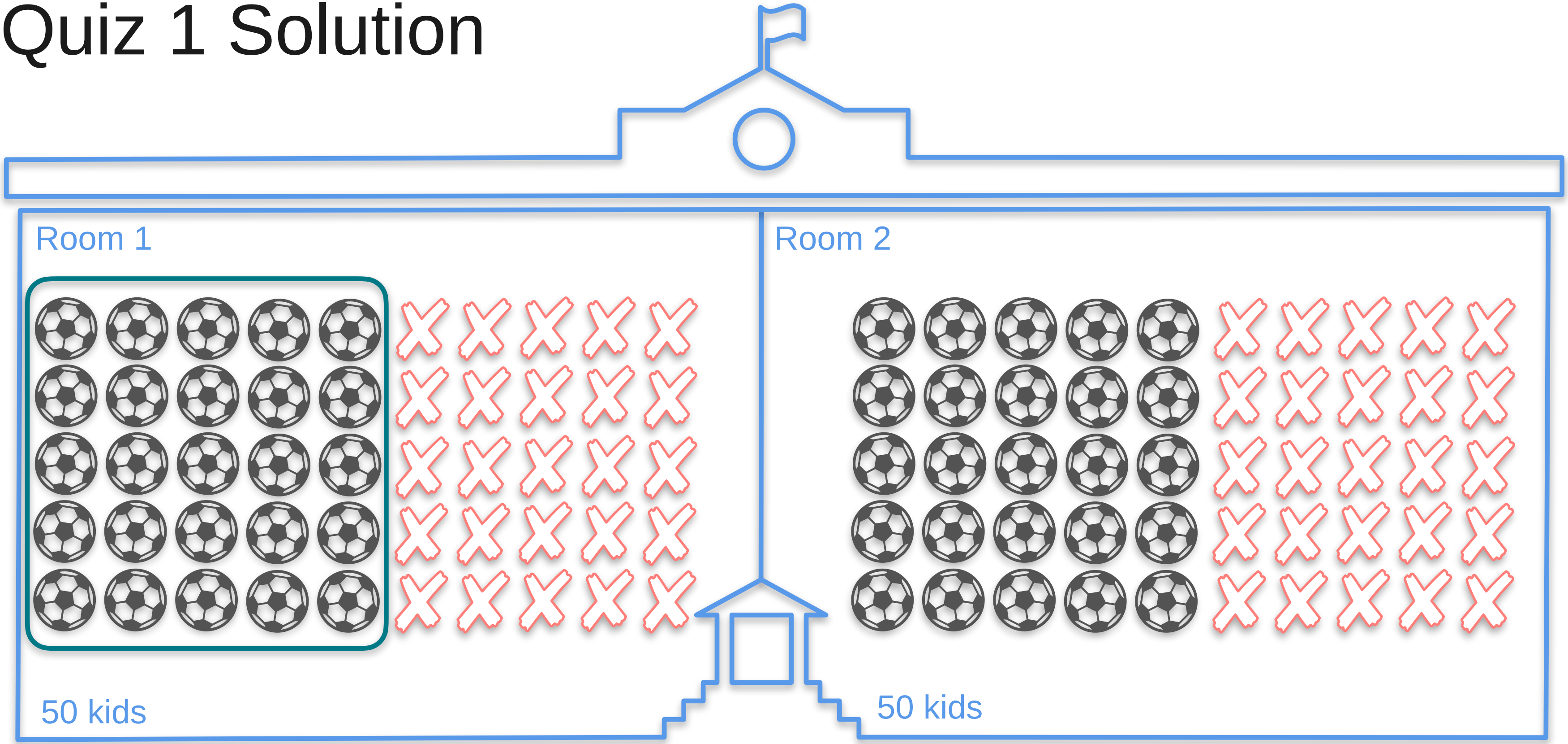
How many kids in room 1 like soccer?

Quiz 1 Solution

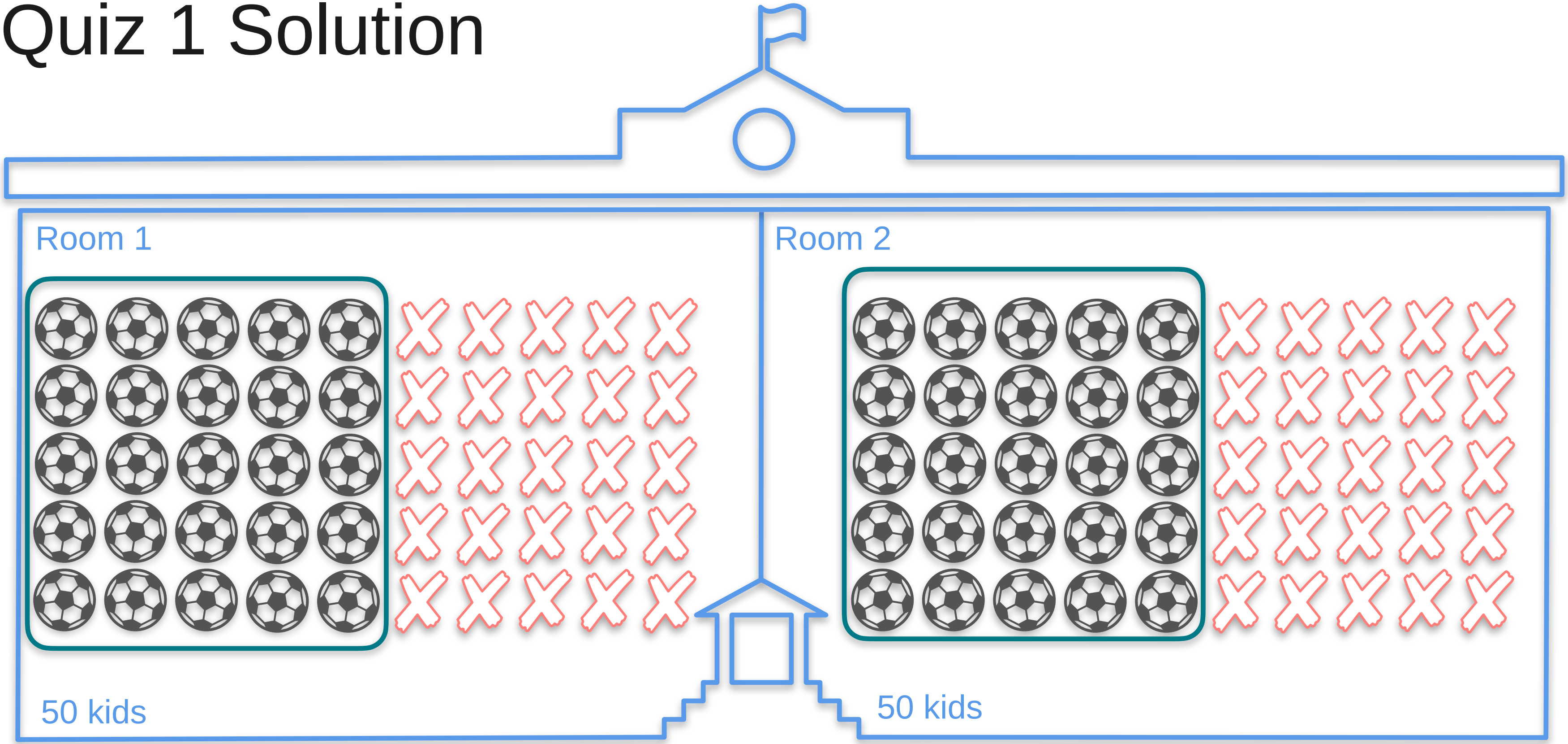


DeepLearning.AI

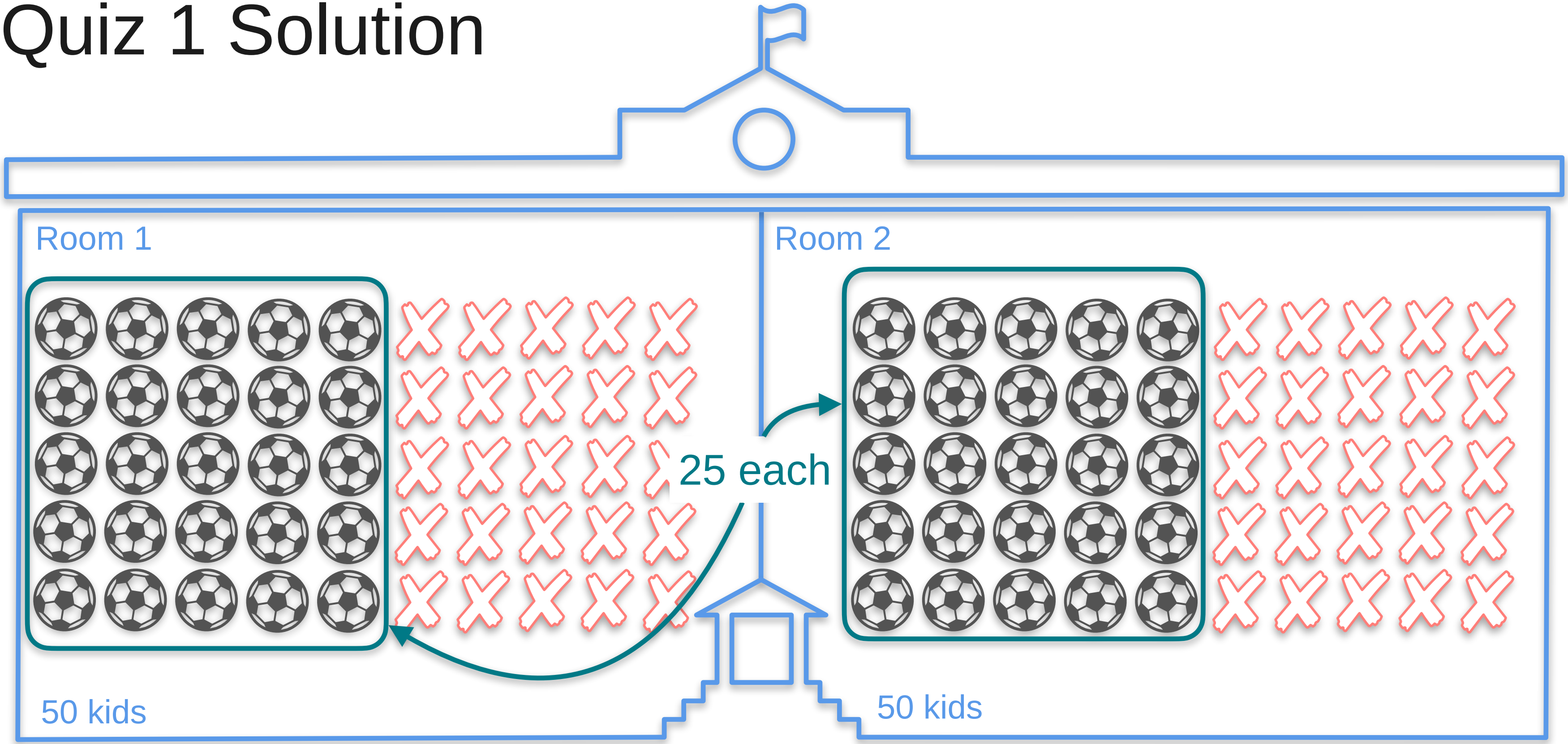
Quiz 1 Solution



Quiz 1 Solution



Quiz 1 Solution



Independence: Quiz 2

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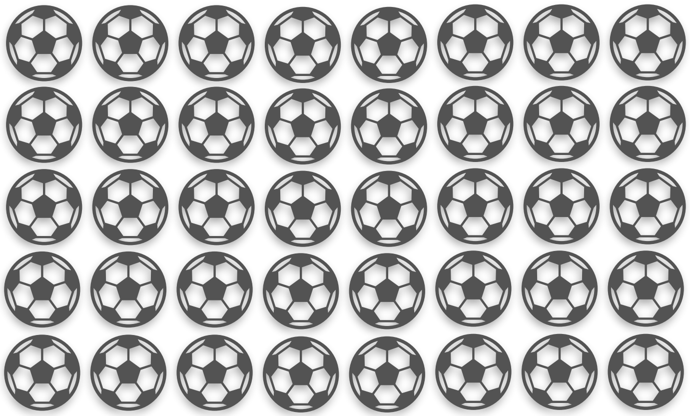
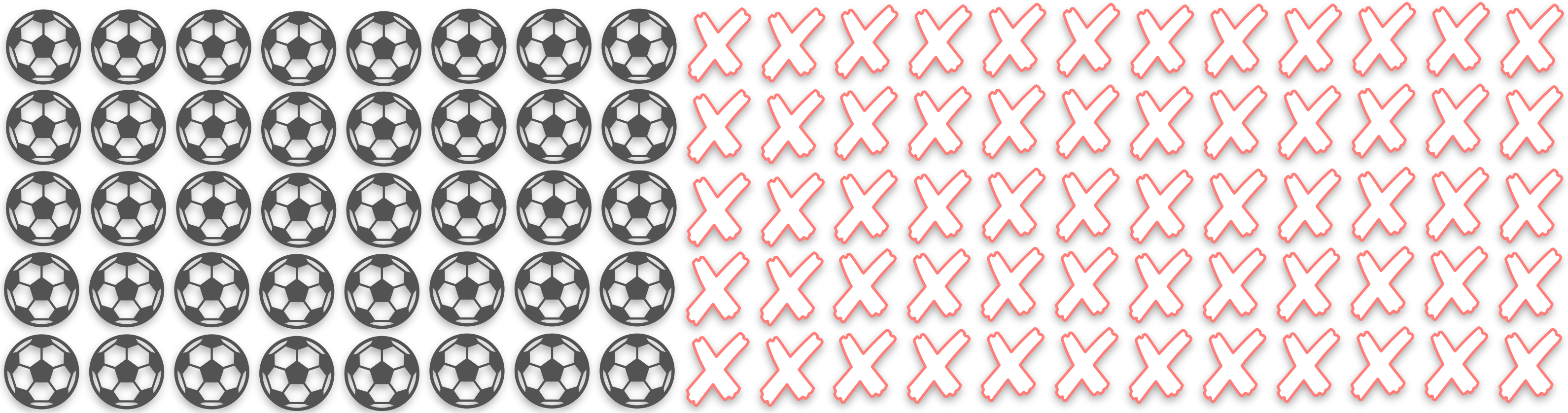
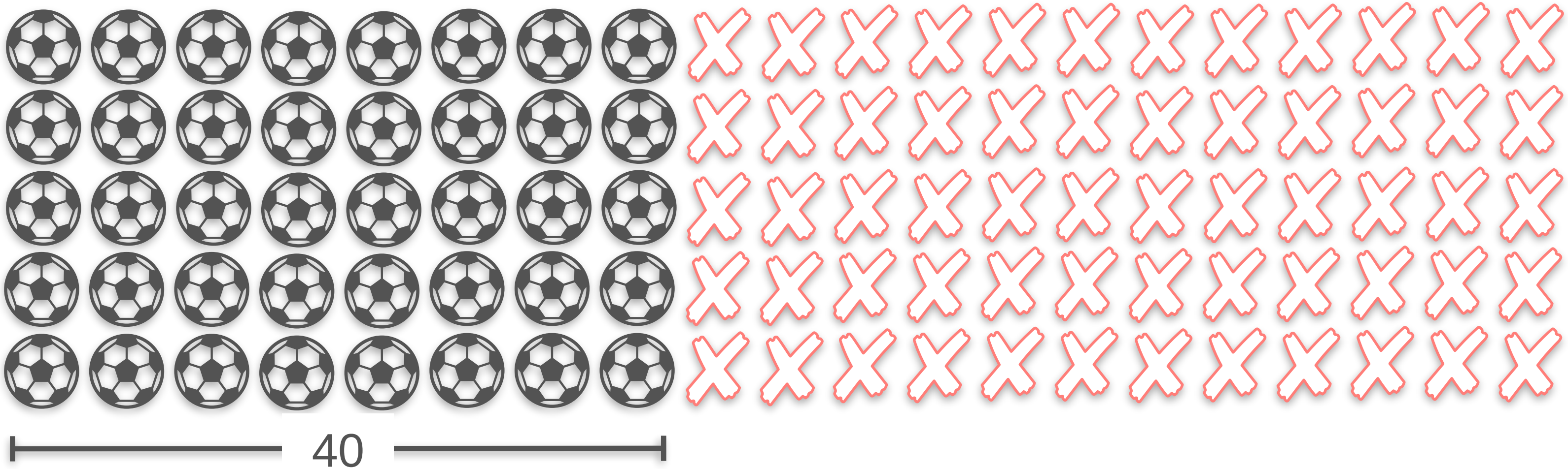


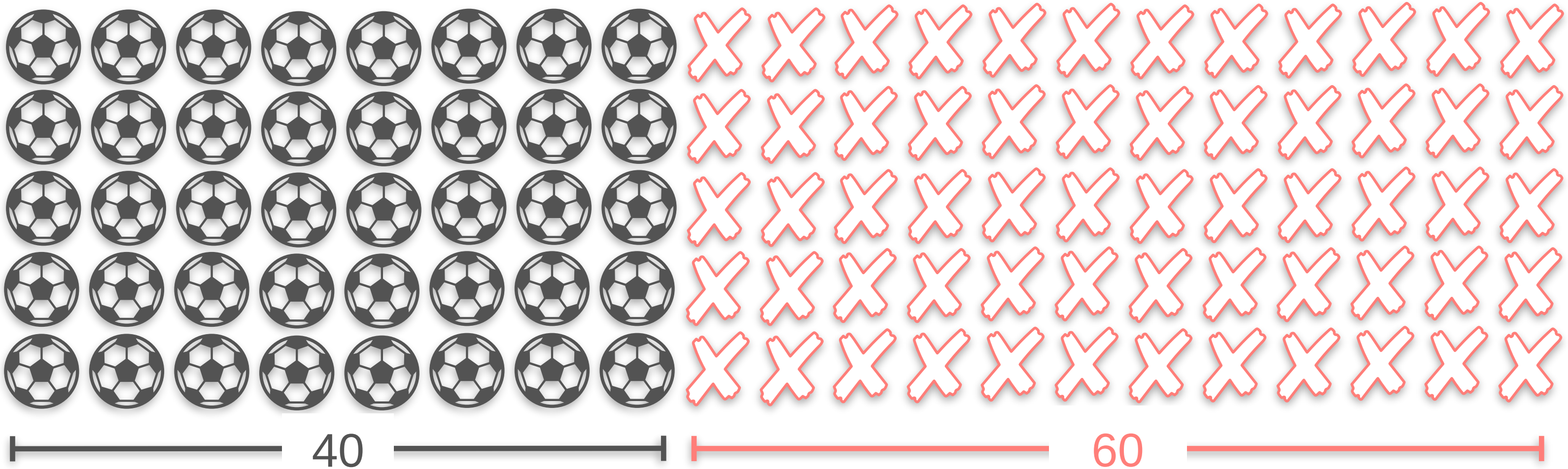
Independence: Quiz 2



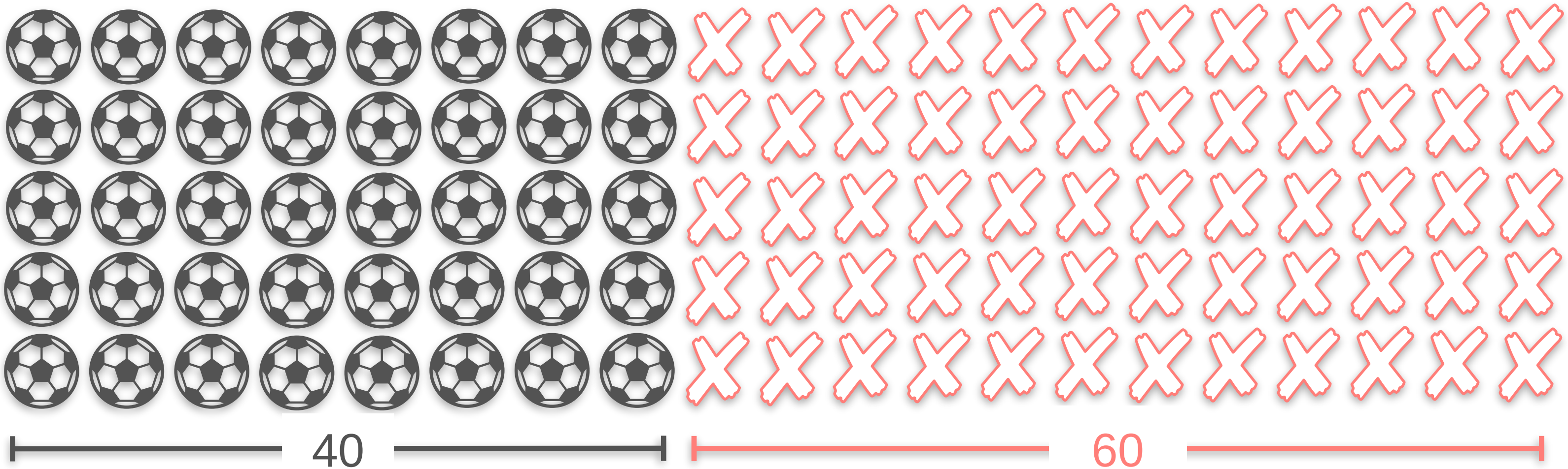
Independence: Quiz 2



Independence: Quiz 2

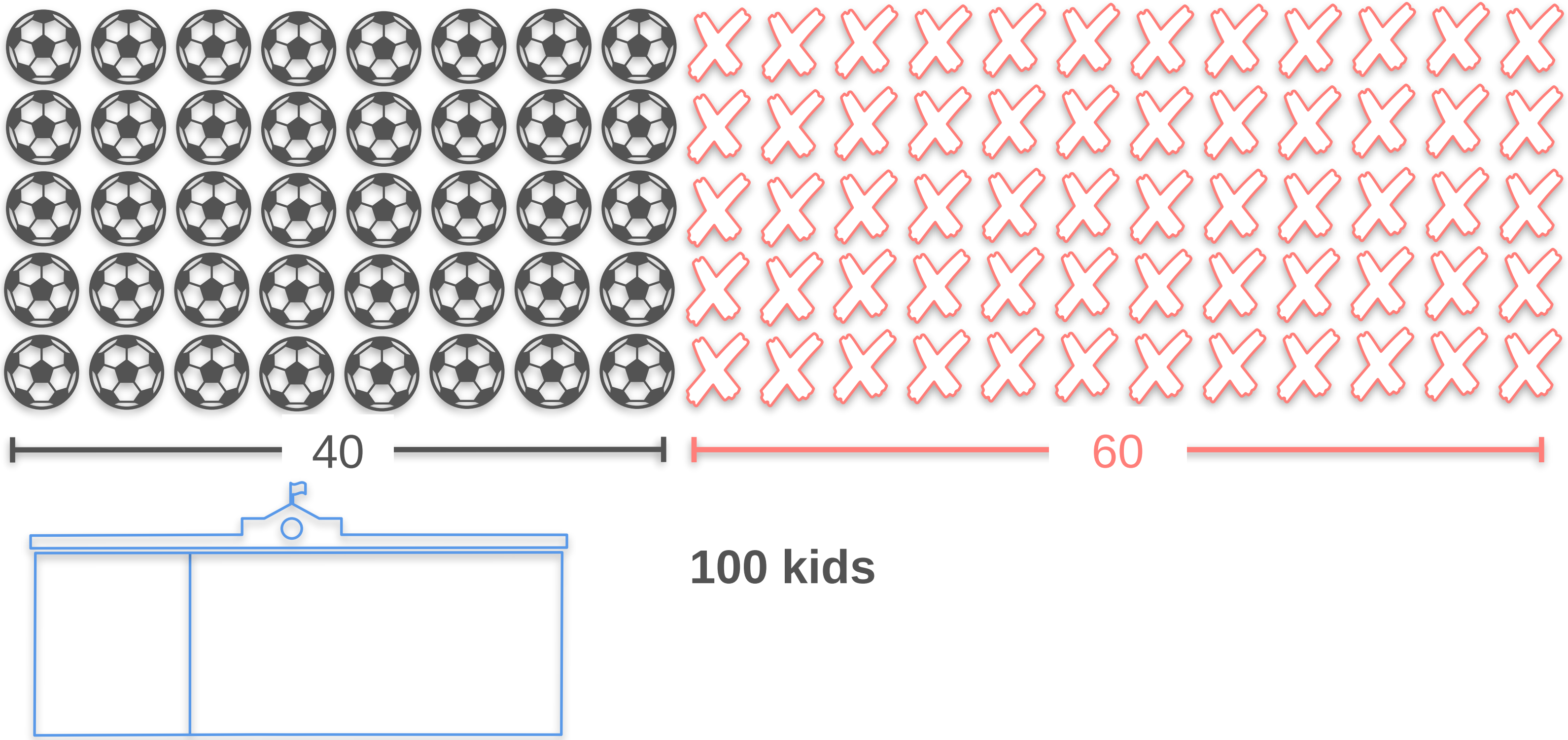


Independence: Quiz 2

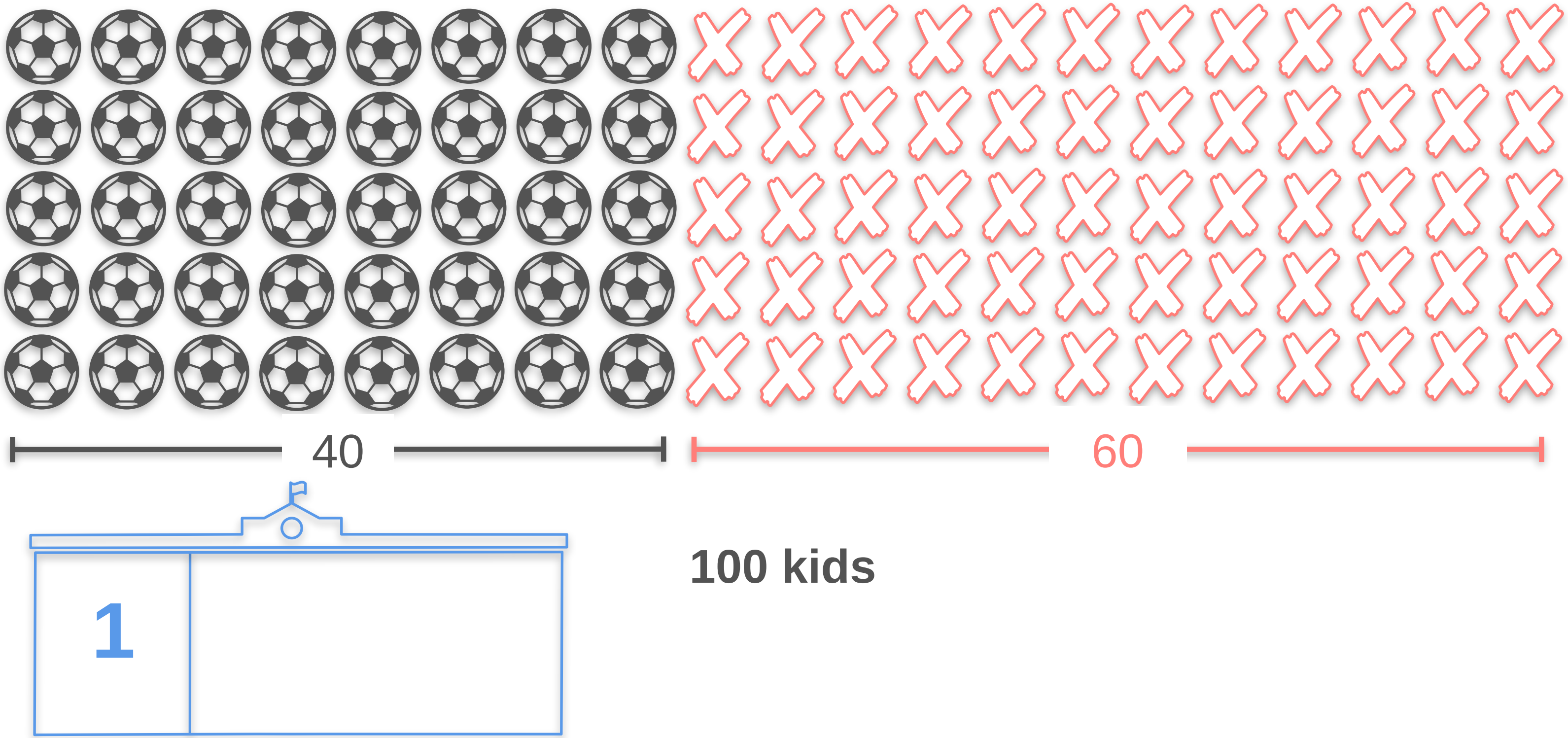


100 kids

Independence: Quiz 2

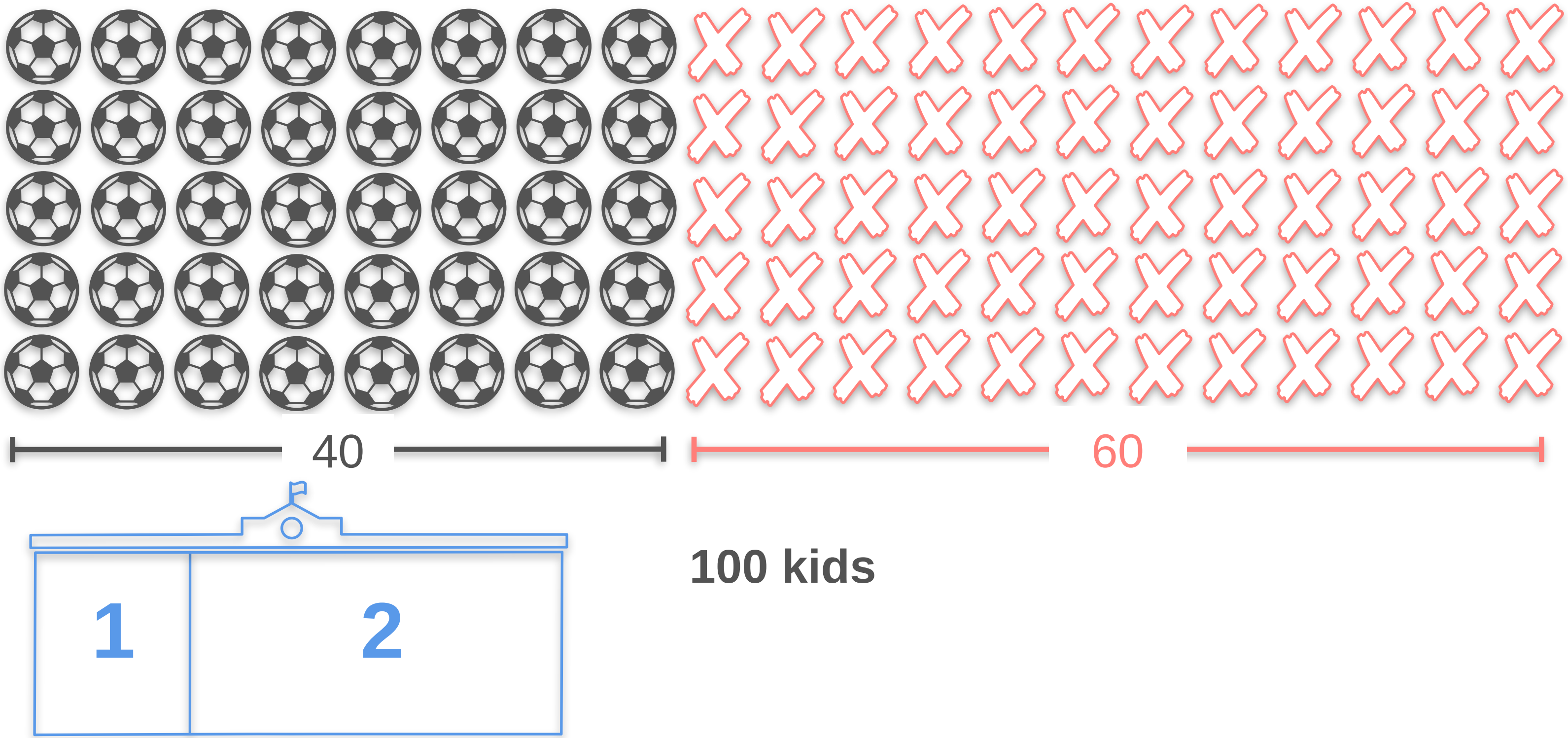


Independence: Quiz 2



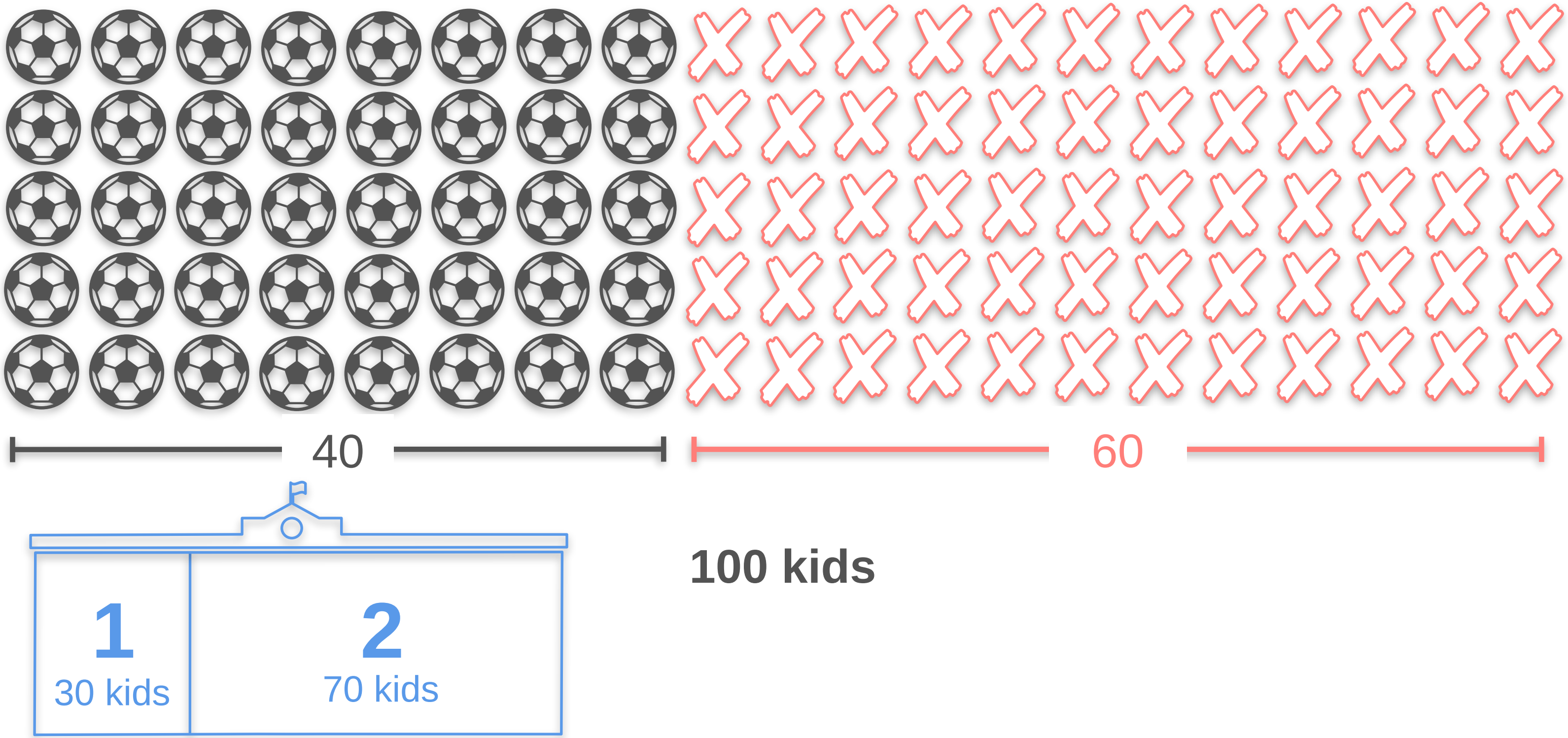
100 kids

Independence: Quiz 2



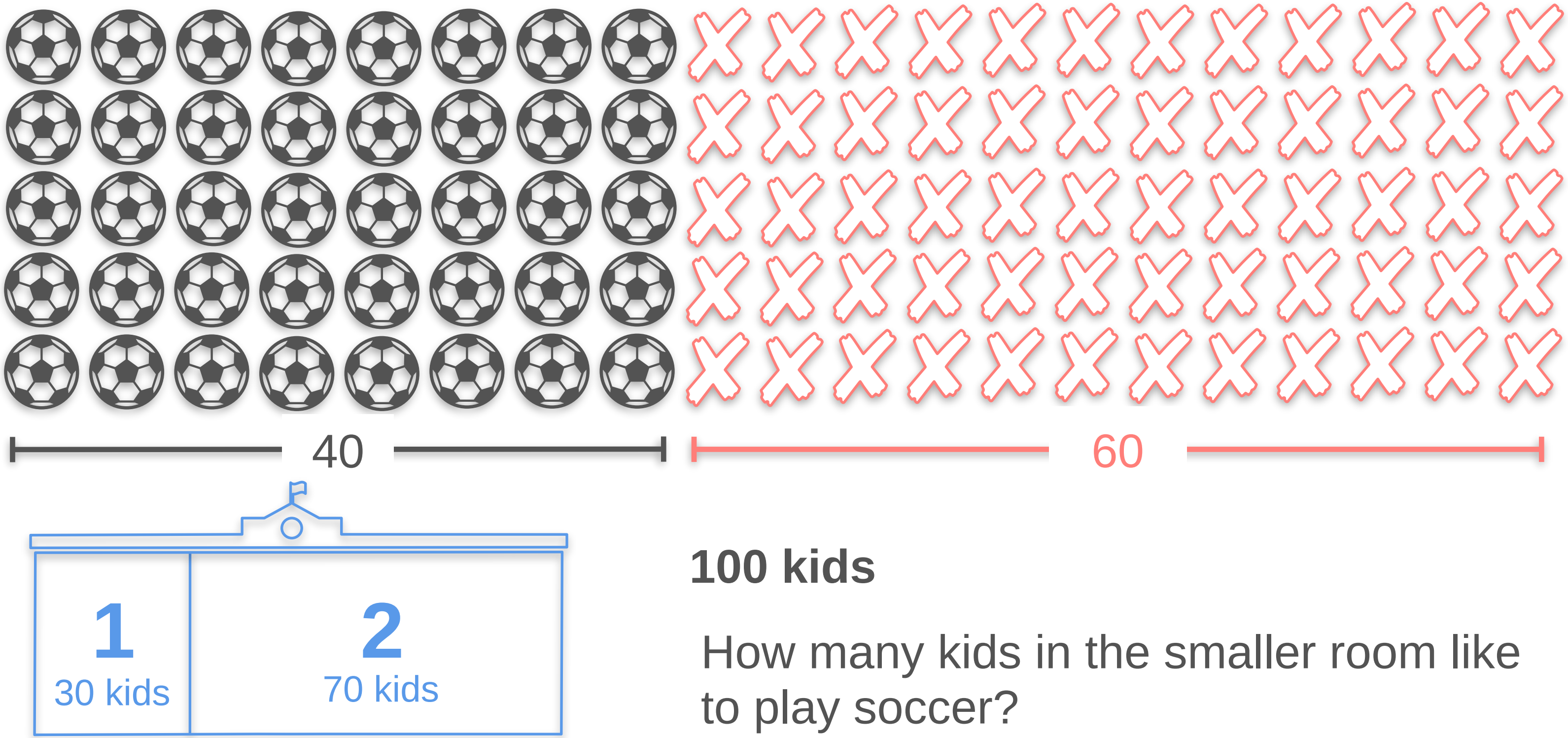
100 kids

Independence: Quiz 2



100 kids

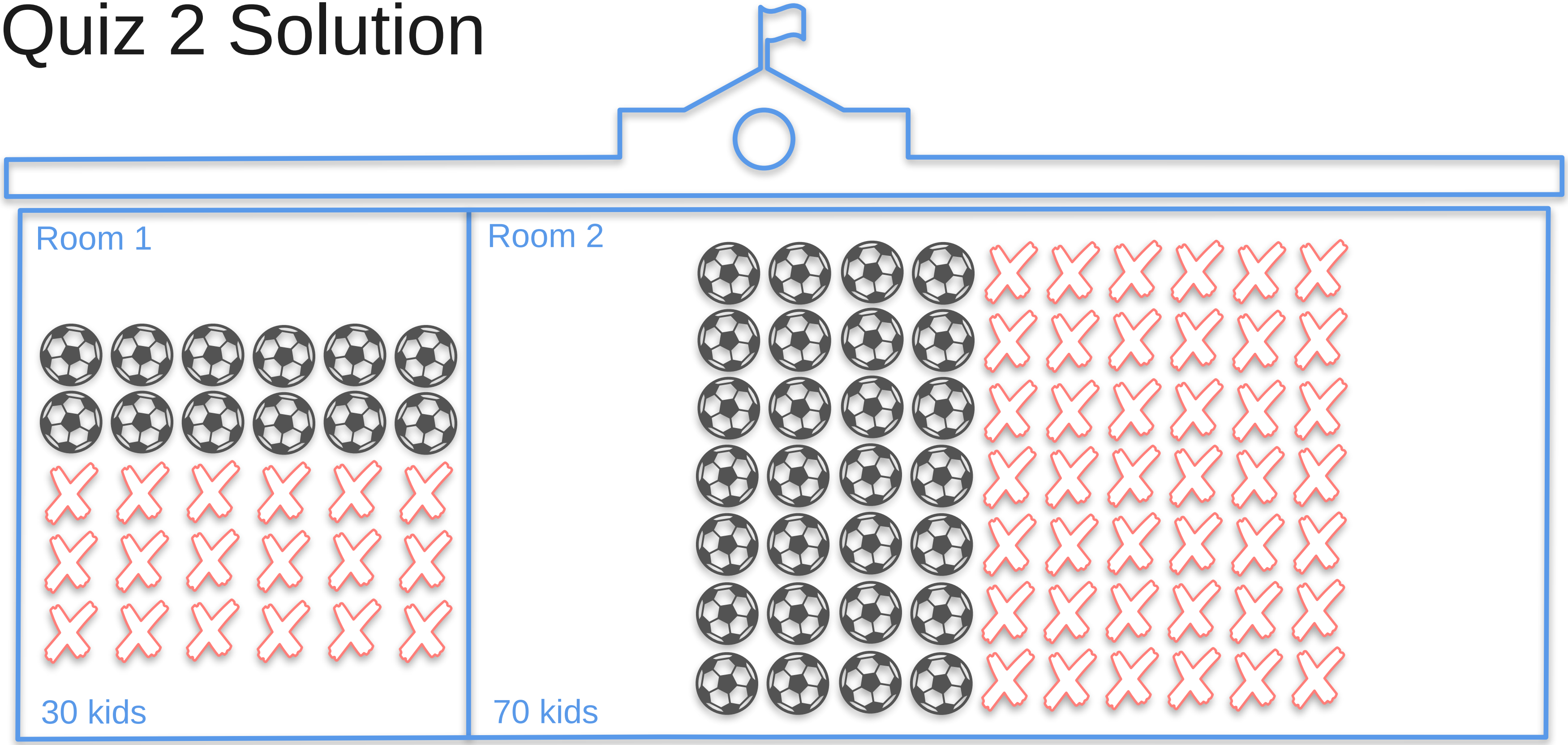
Independence: Quiz 2



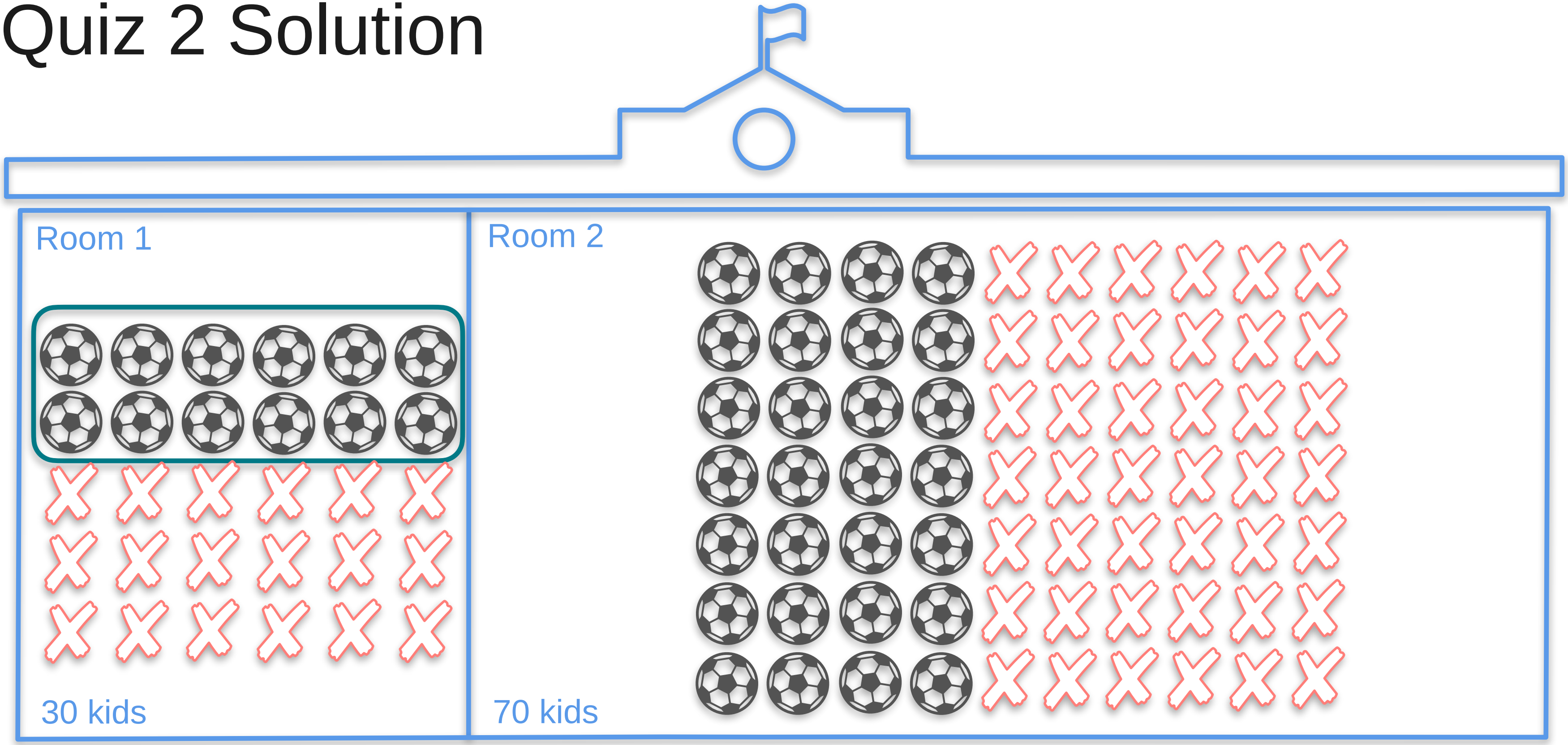
100 kids

How many kids in the smaller room like to play soccer?

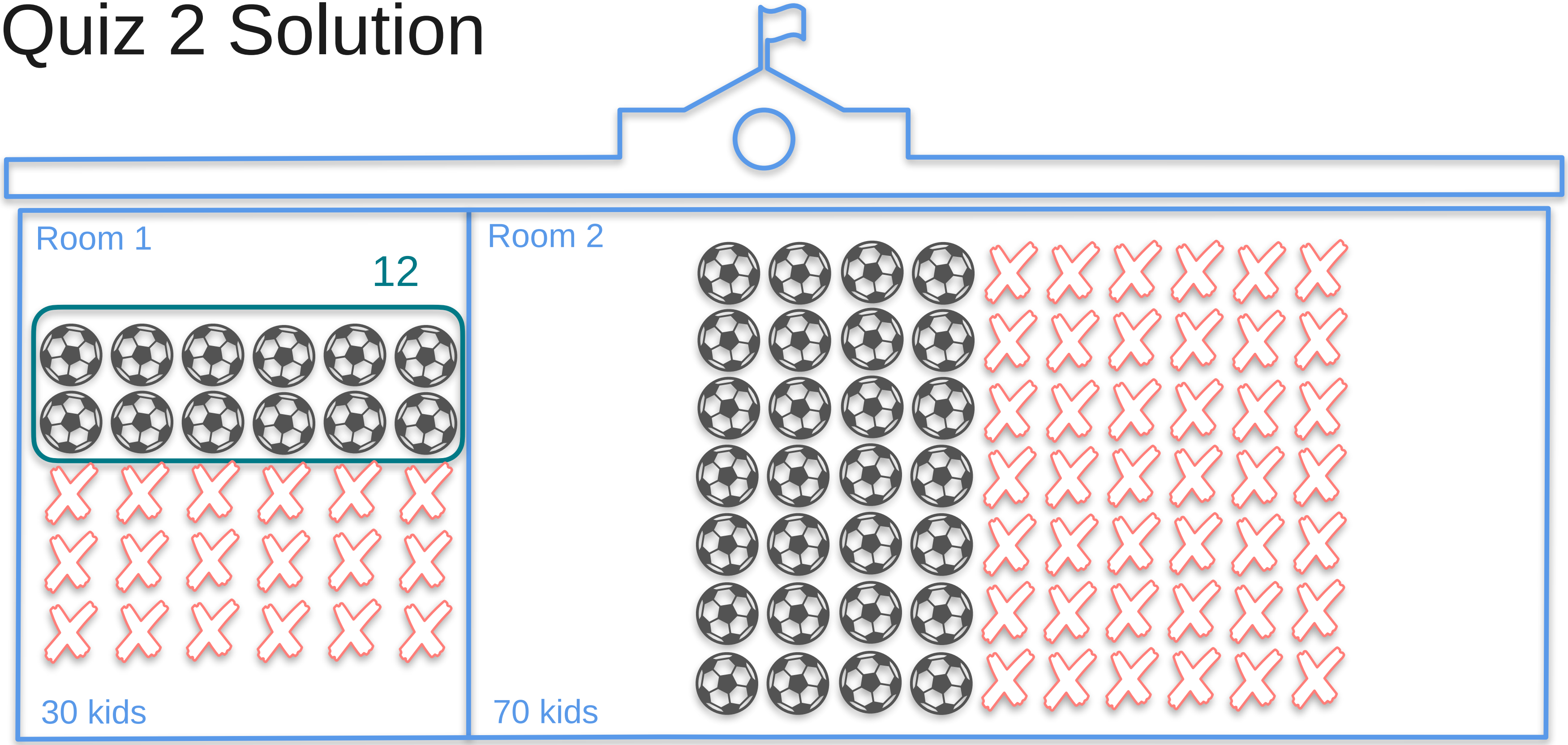
Quiz 2 Solution



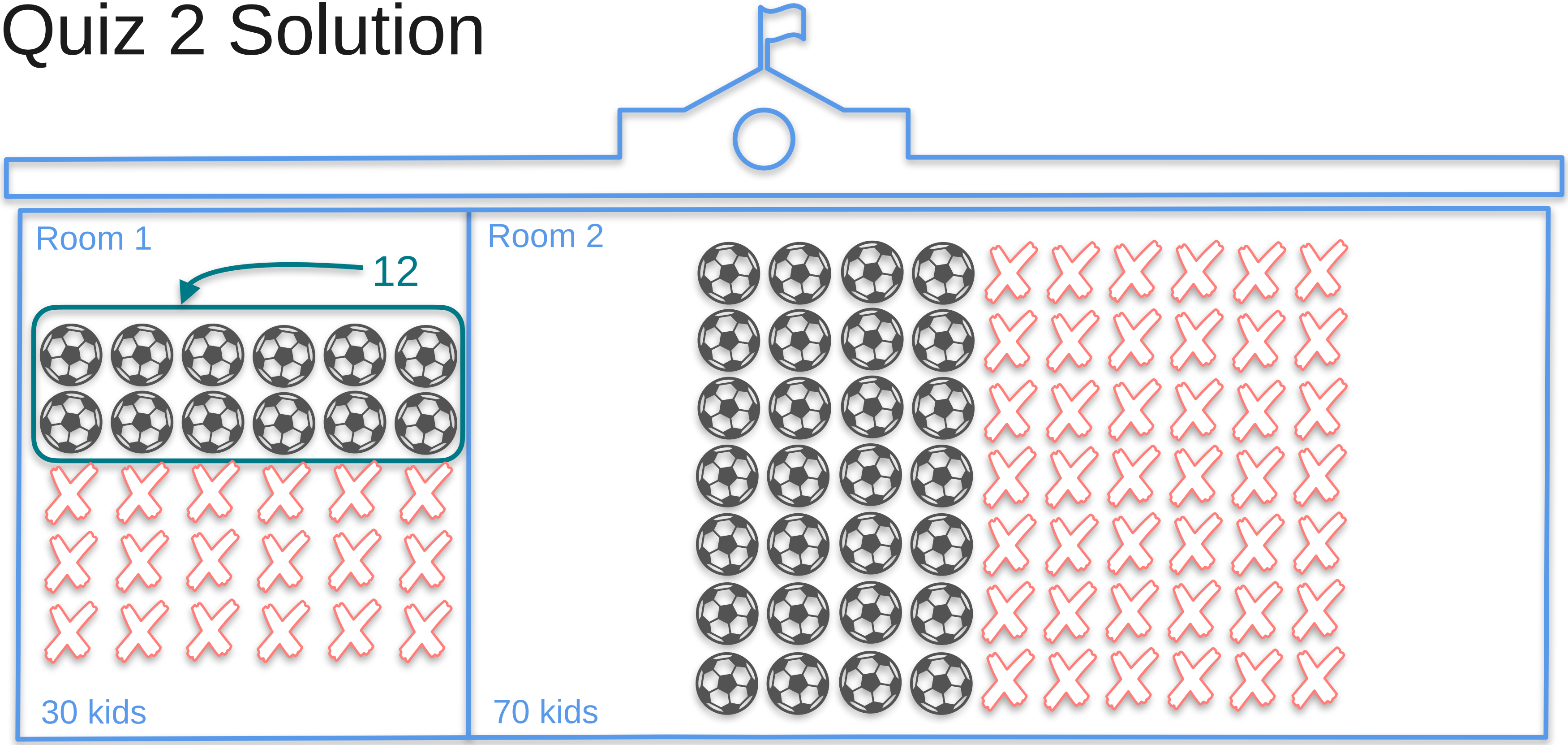
Quiz 2 Solution



Quiz 2 Solution

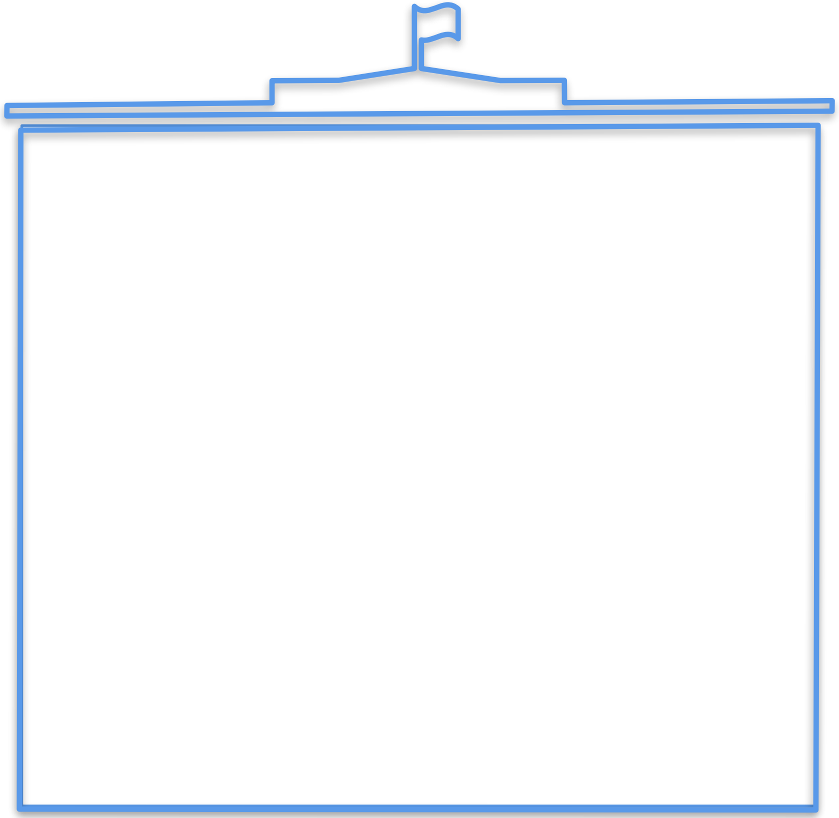


Quiz 2 Solution



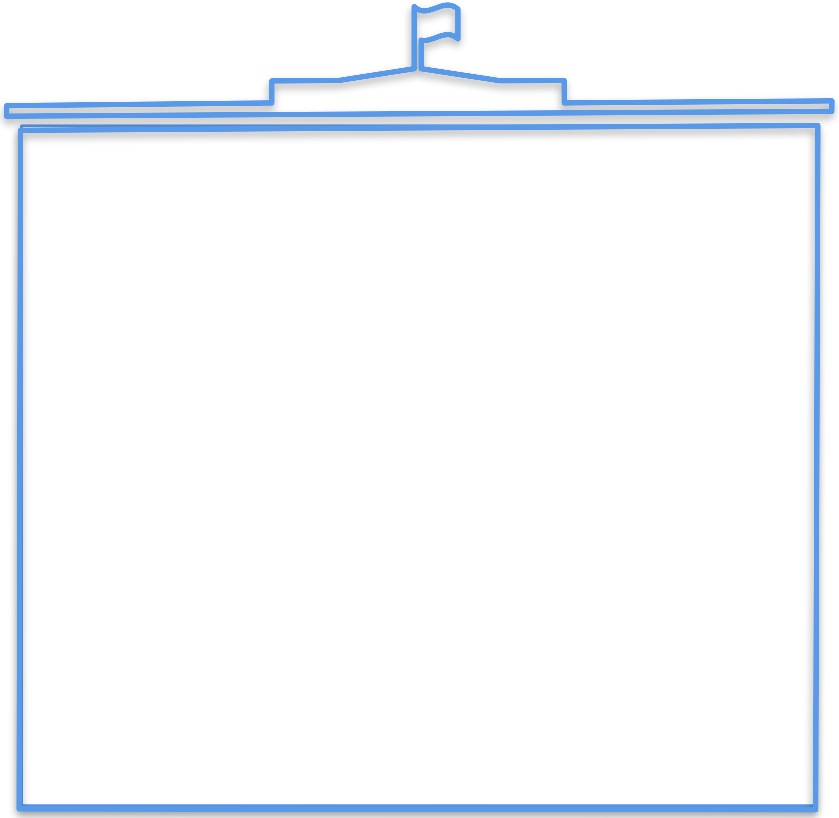
Independent Events

Independent Events



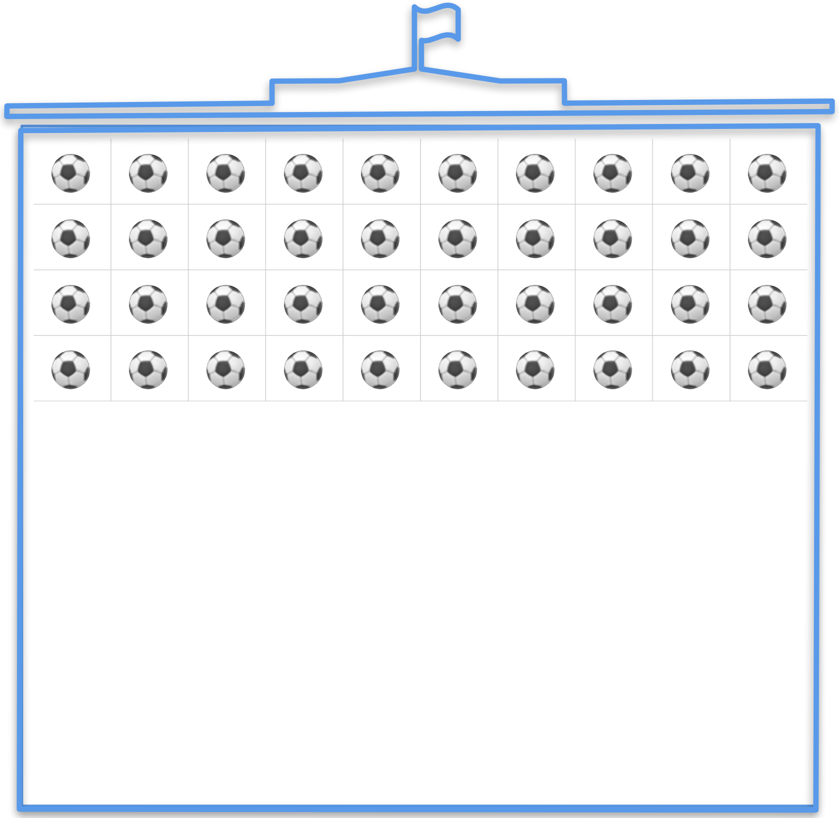
Independent Events

$$P(S) = 0.4$$



Independent Events

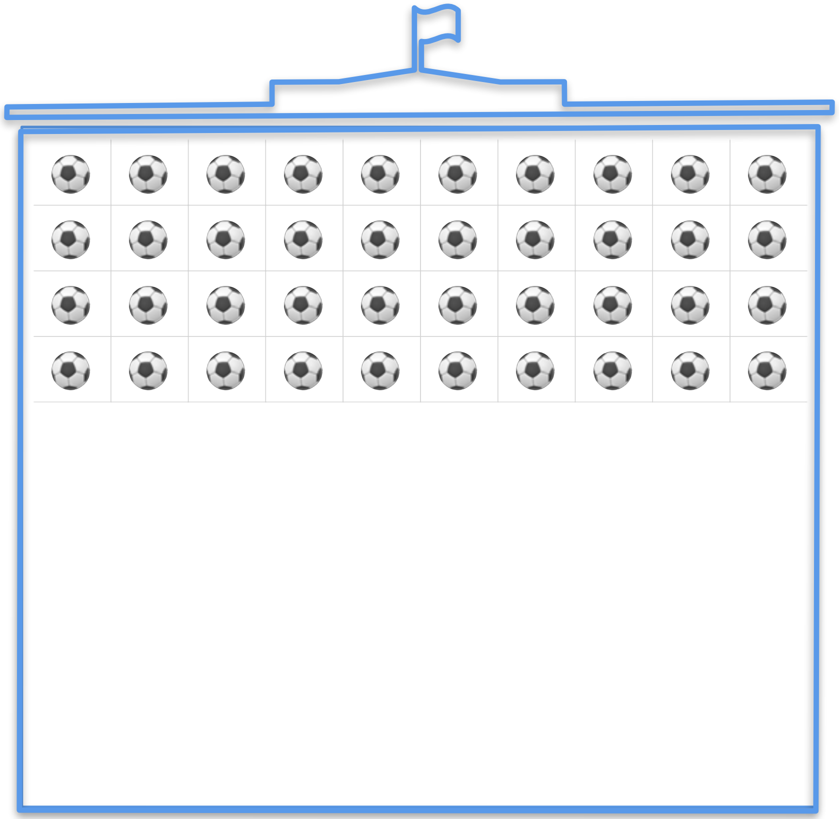
$$\mathbf{P}(S) = 0.4$$



Independent Events

$\mathbf{P}(S) = 0.4$

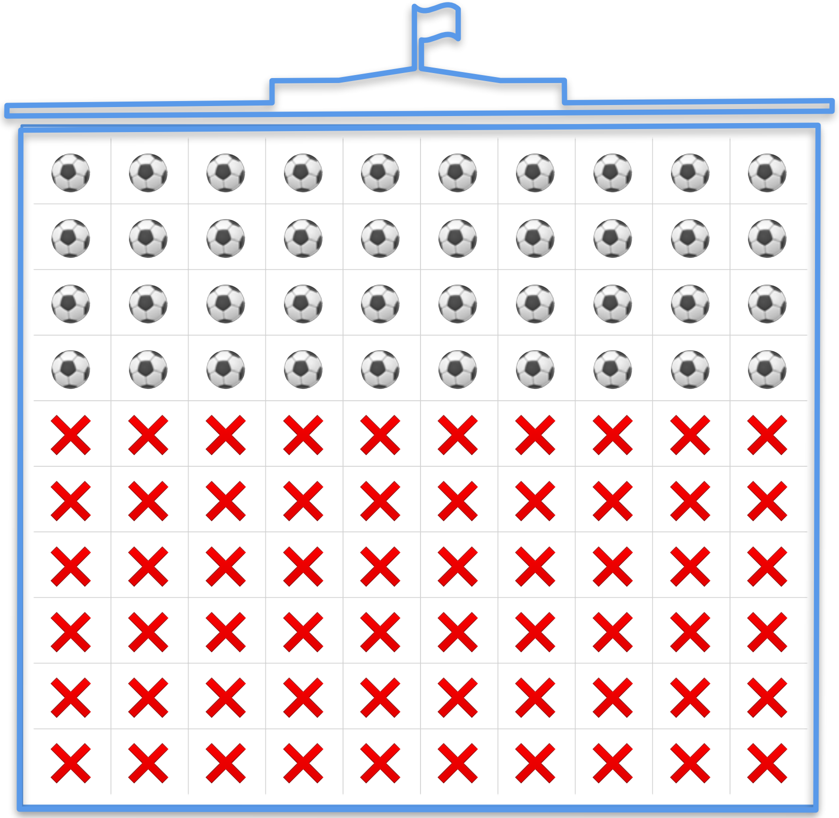
$\mathbf{P}(\text{not } S) = 0.6$



Independent Events

$\mathbf{P}(S) = 0.4$

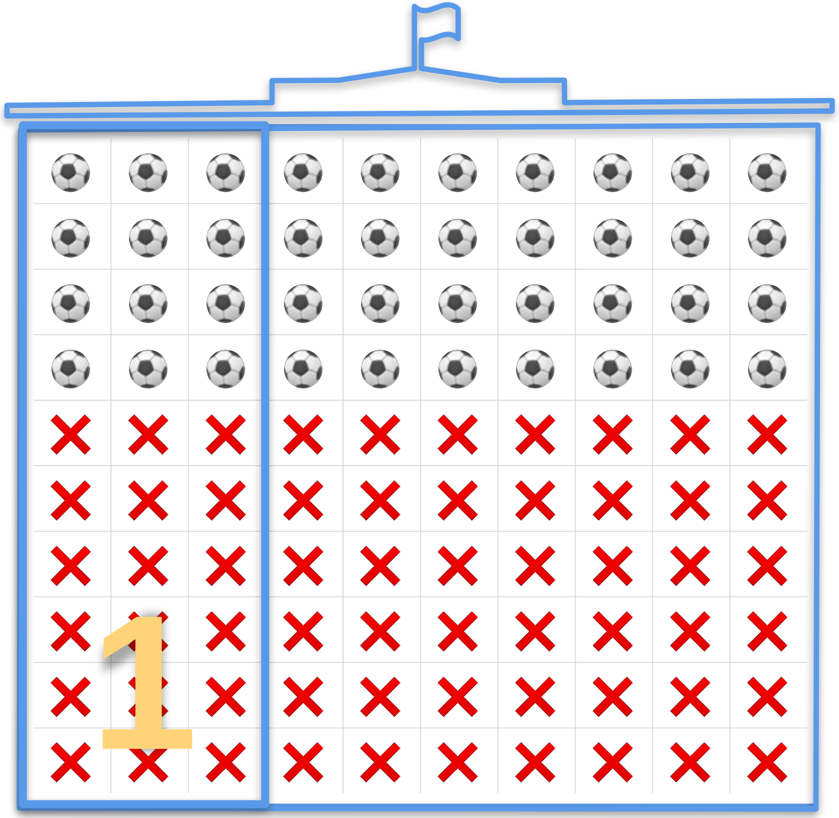
$\mathbf{P}(\text{not } S) = 0.6$



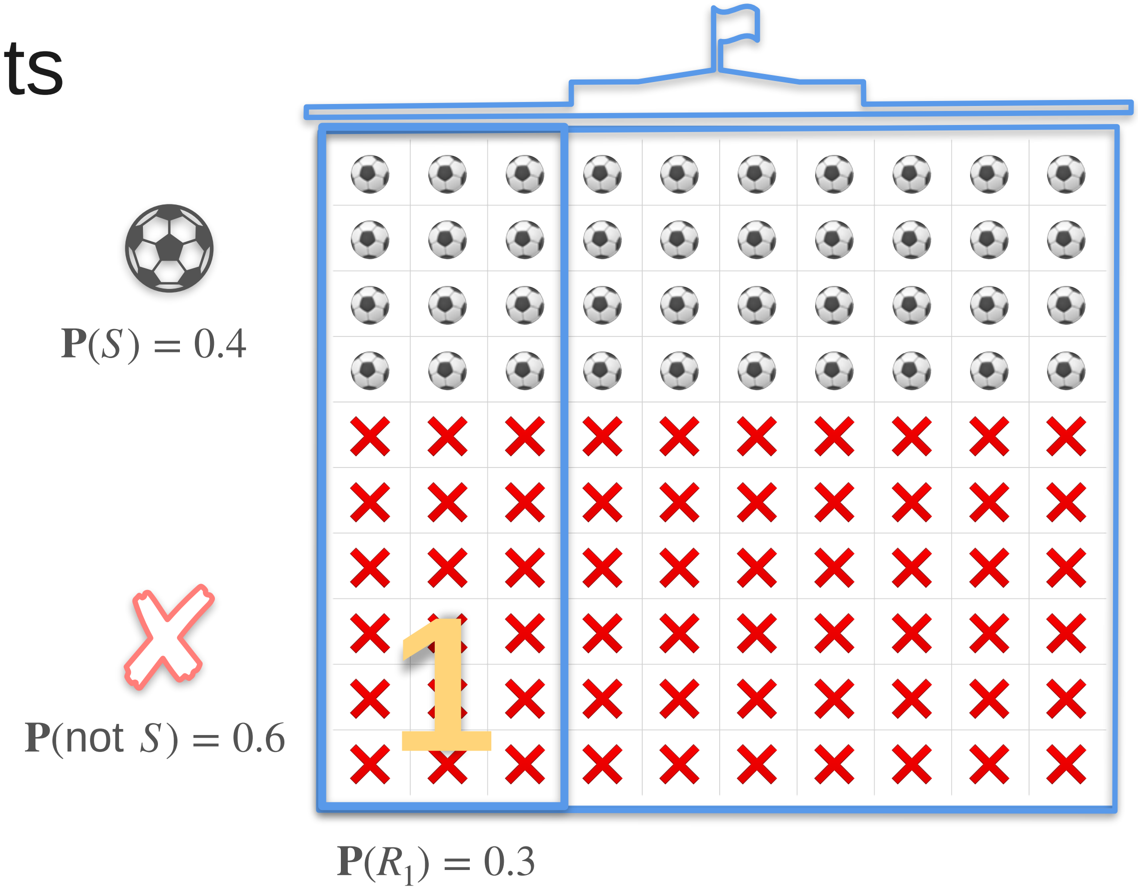
Independent Events

$\mathbf{P}(S) = 0.4$

$\mathbf{P}(\text{not } S) = 0.6$

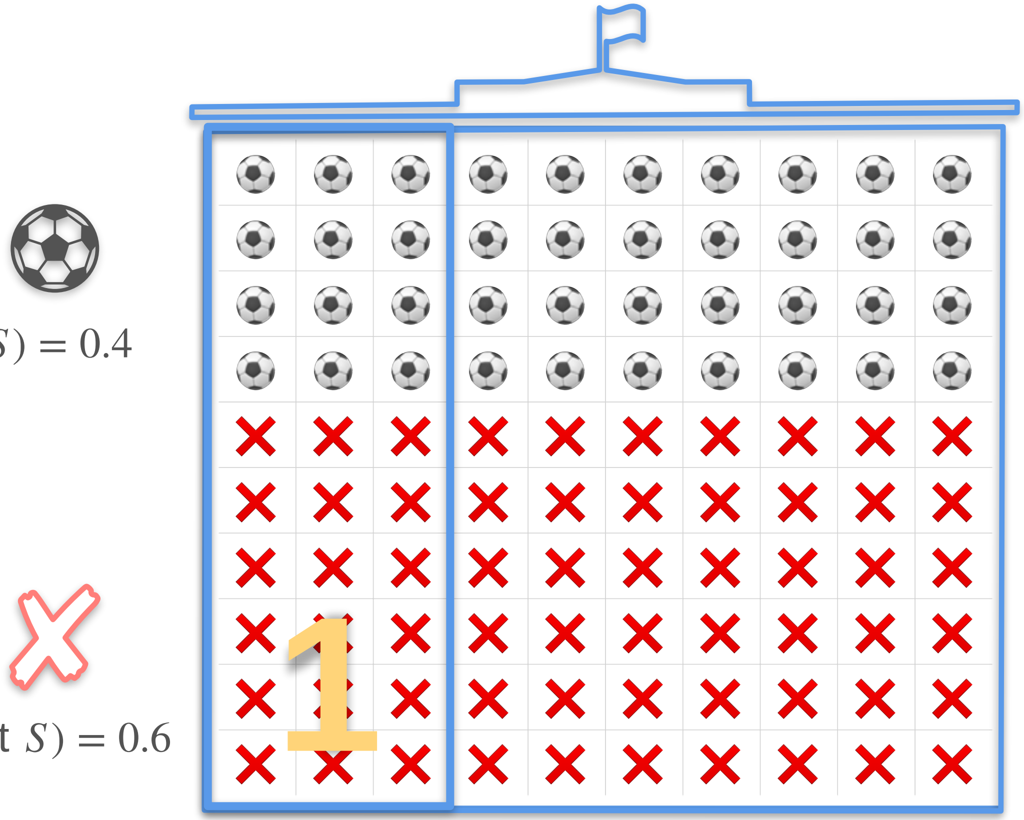


Independent Events



Independent Events

$\mathbf{P}$(Soccer and Room 1)



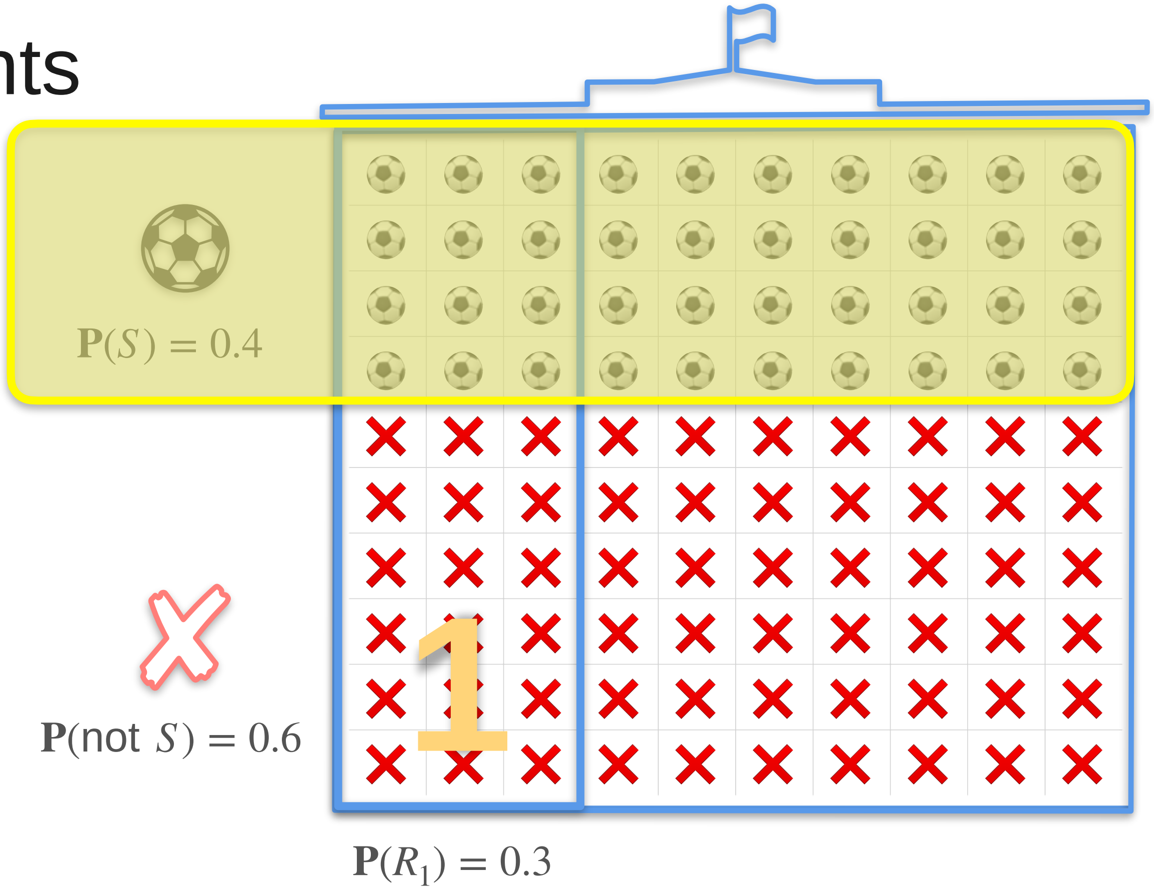
$\mathbf{P}(S) = 0.4$

$\mathbf{P}(\text{not } S) = 0.6$

$\mathbf{P}(R_1) = 0.3$

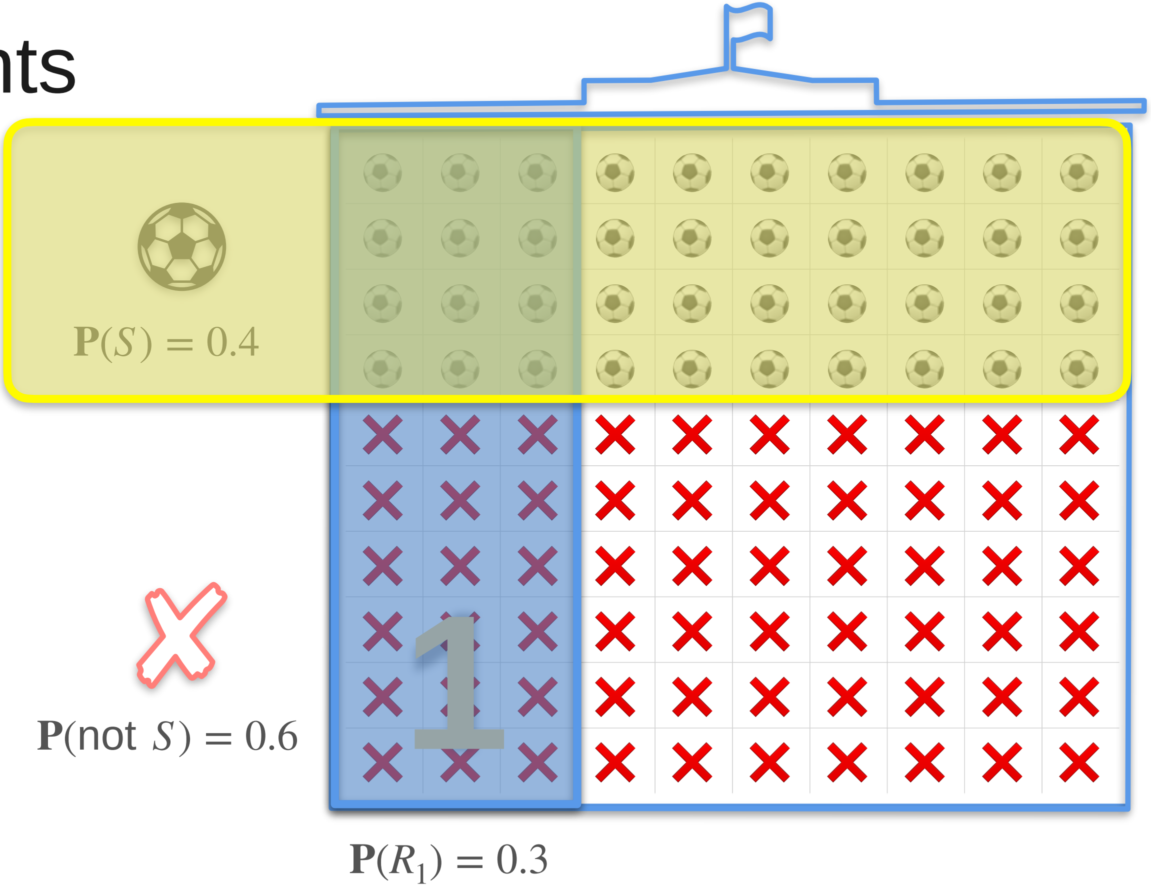
Independent Events

$\mathbf{P}$(Soccer and Room 1)



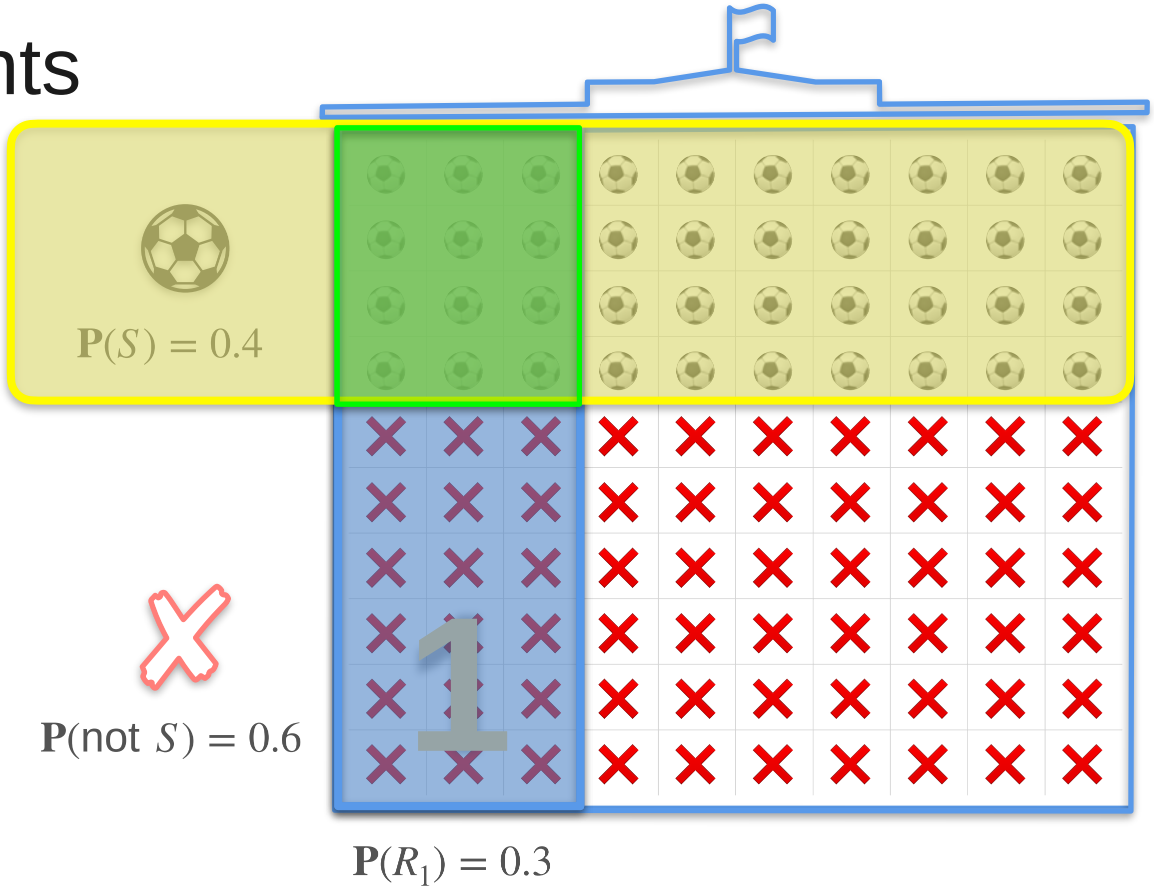
Independent Events

$\mathbf{P}$(Soccer and Room 1)



Independent Events

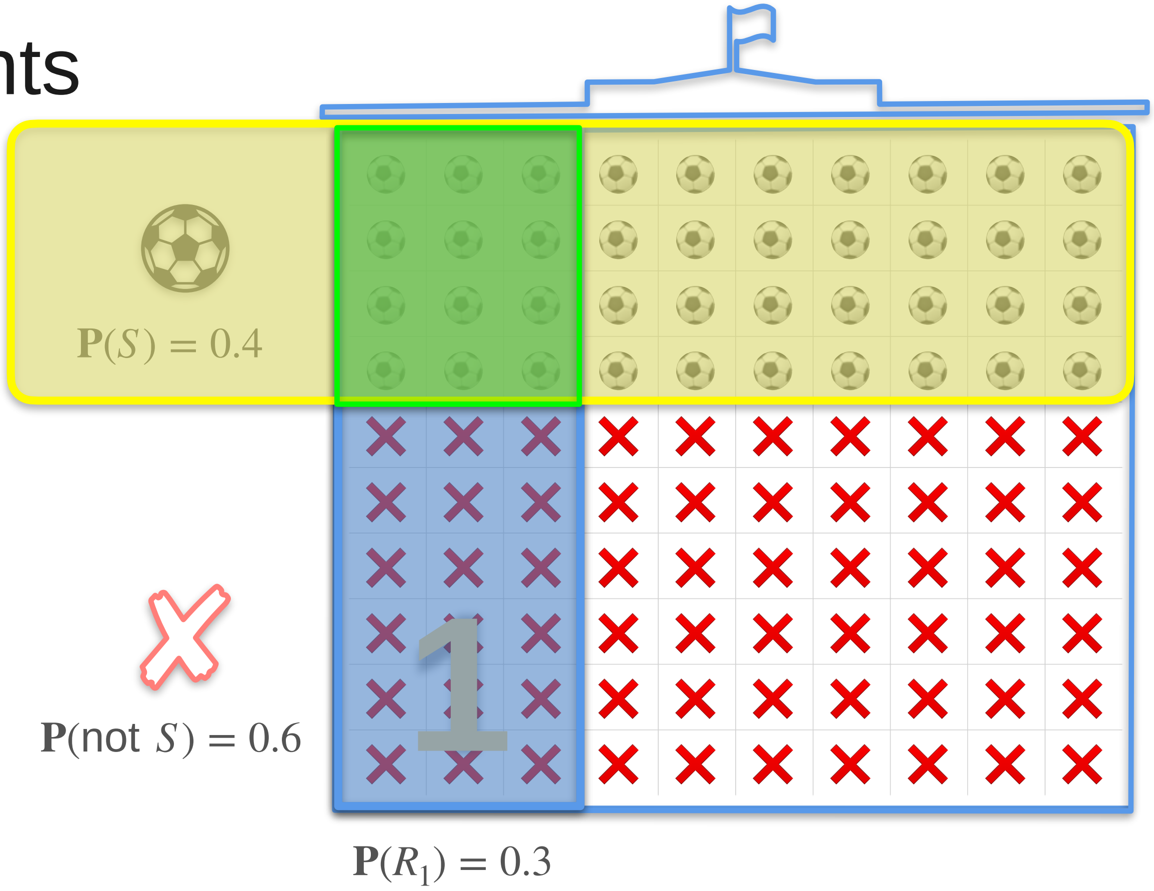
$\mathbf{P}$(Soccer and Room 1)



Independent Events

$\mathbf{P}$(Soccer and Room 1)

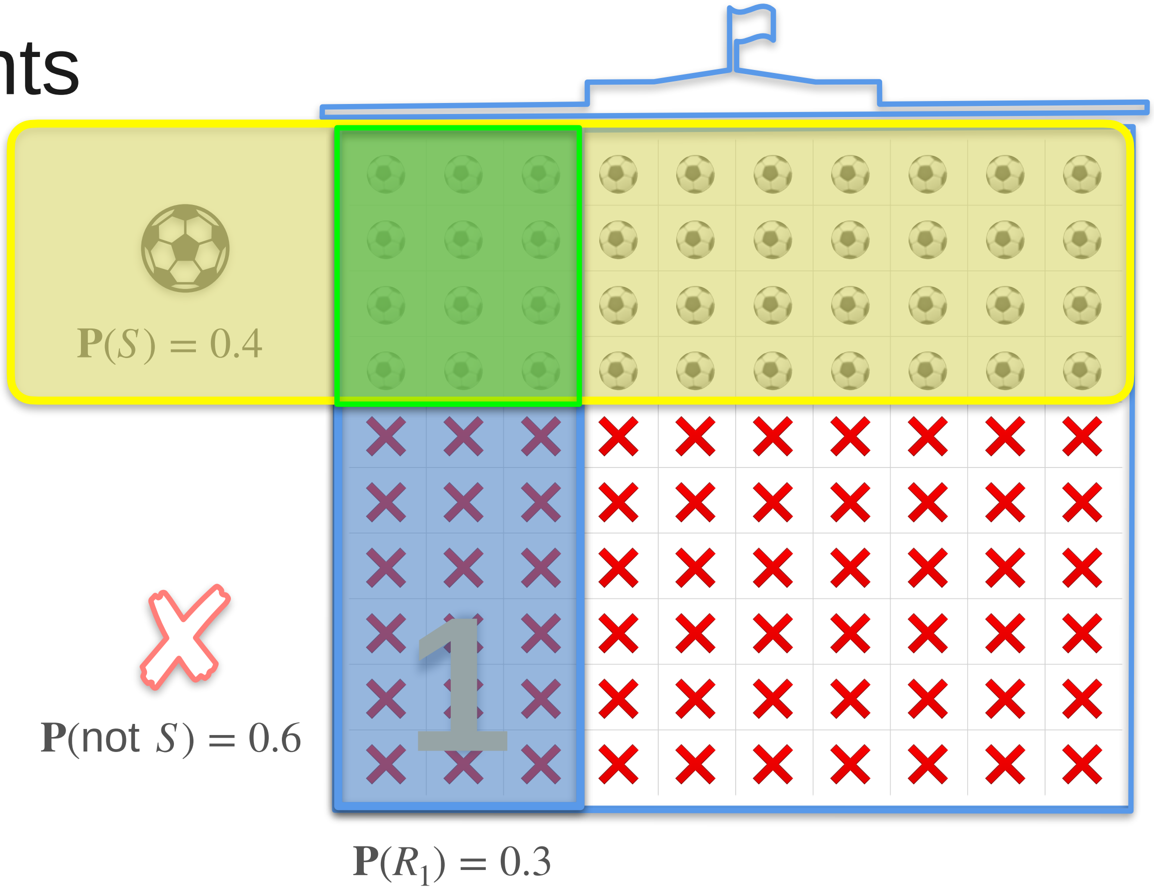
$\mathbf{P}(S \cap R_1) =$



Independent Events

$\mathbf{P}(\text{Soccer and Room 1})$

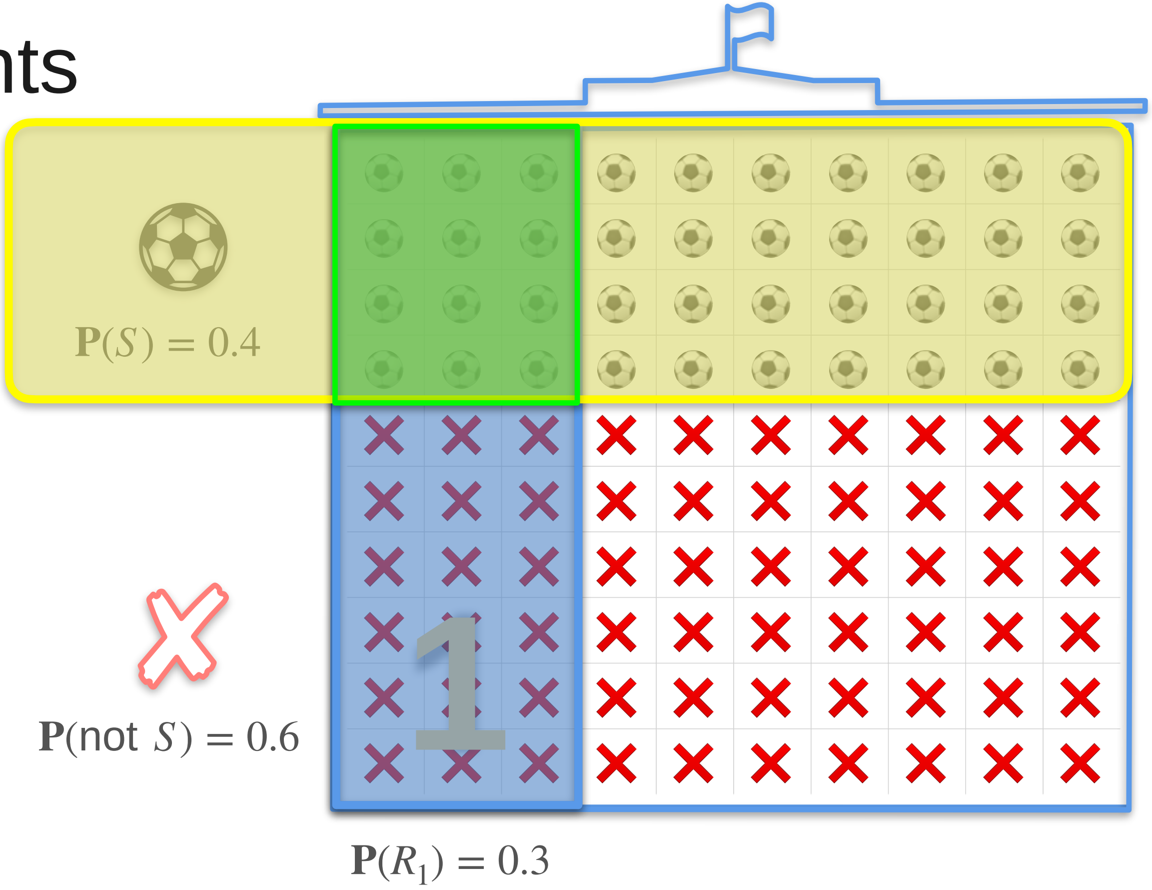
$\mathbf{P}(S \cap R_1) = \quad \mathbf{P}(S)$



Independent Events

$\mathbf{P}$(Soccer and Room 1)

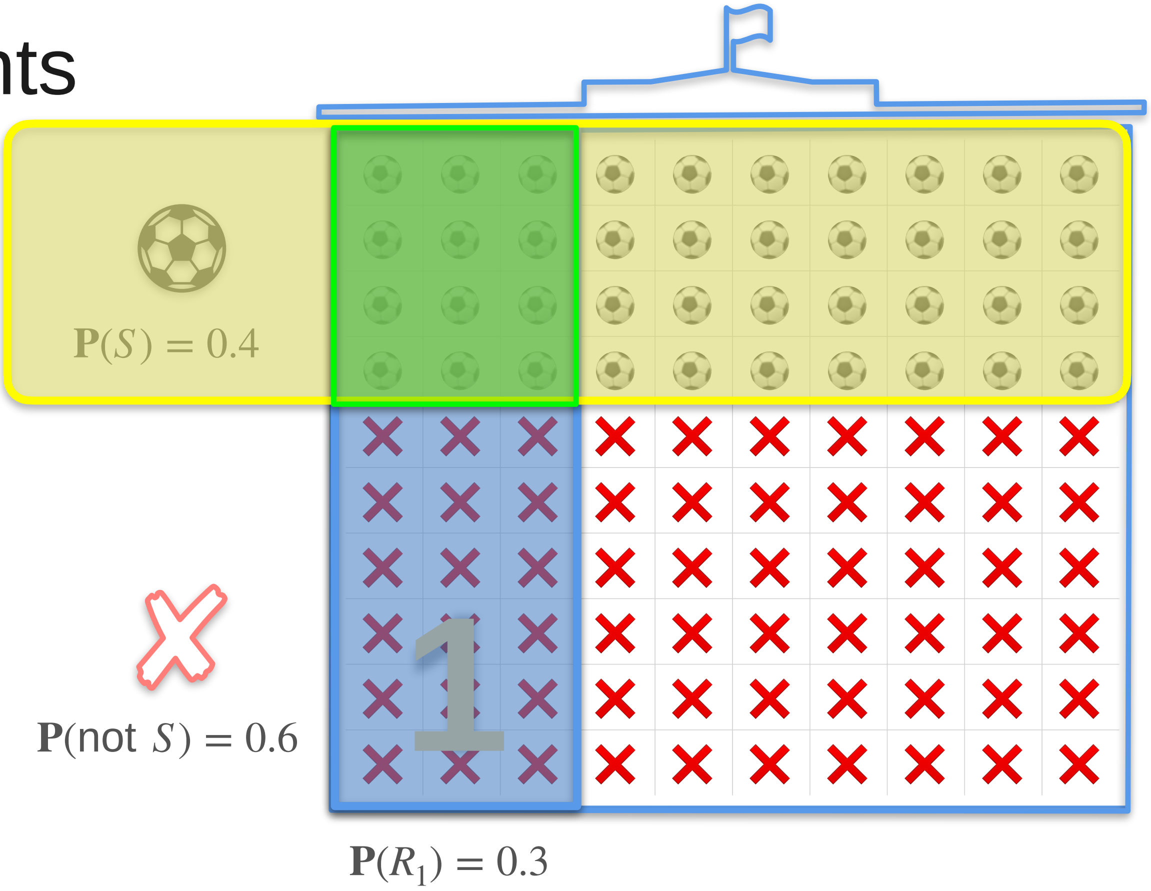
$\mathbf{P}(S \cap R_1) = \quad \mathbf{P}(S)$



Independent Events

$\mathbf{P}$(Soccer and Room 1)

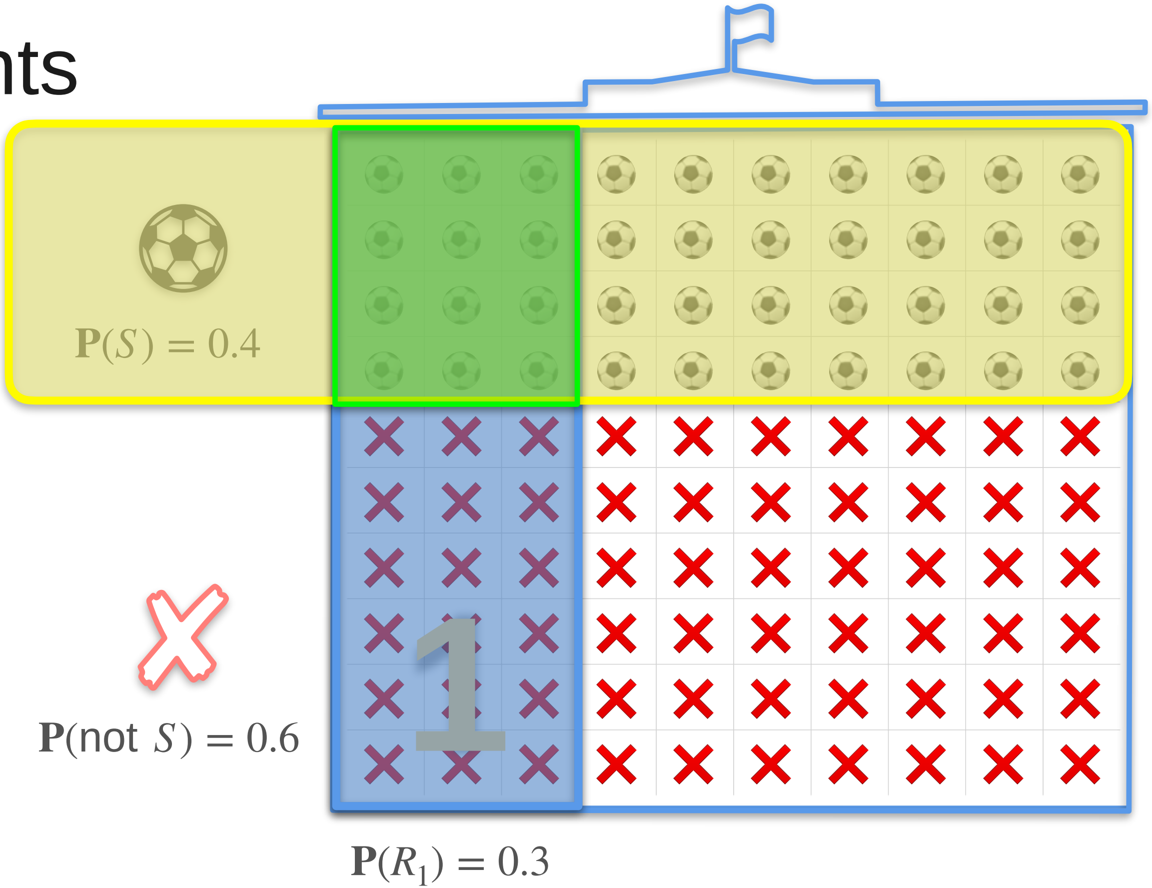
$\mathbf{P}(S \cap R_1) = \quad \mathbf{P}(S) \;\bullet$



Independent Events

$\mathbf{P}$(Soccer and Room 1)

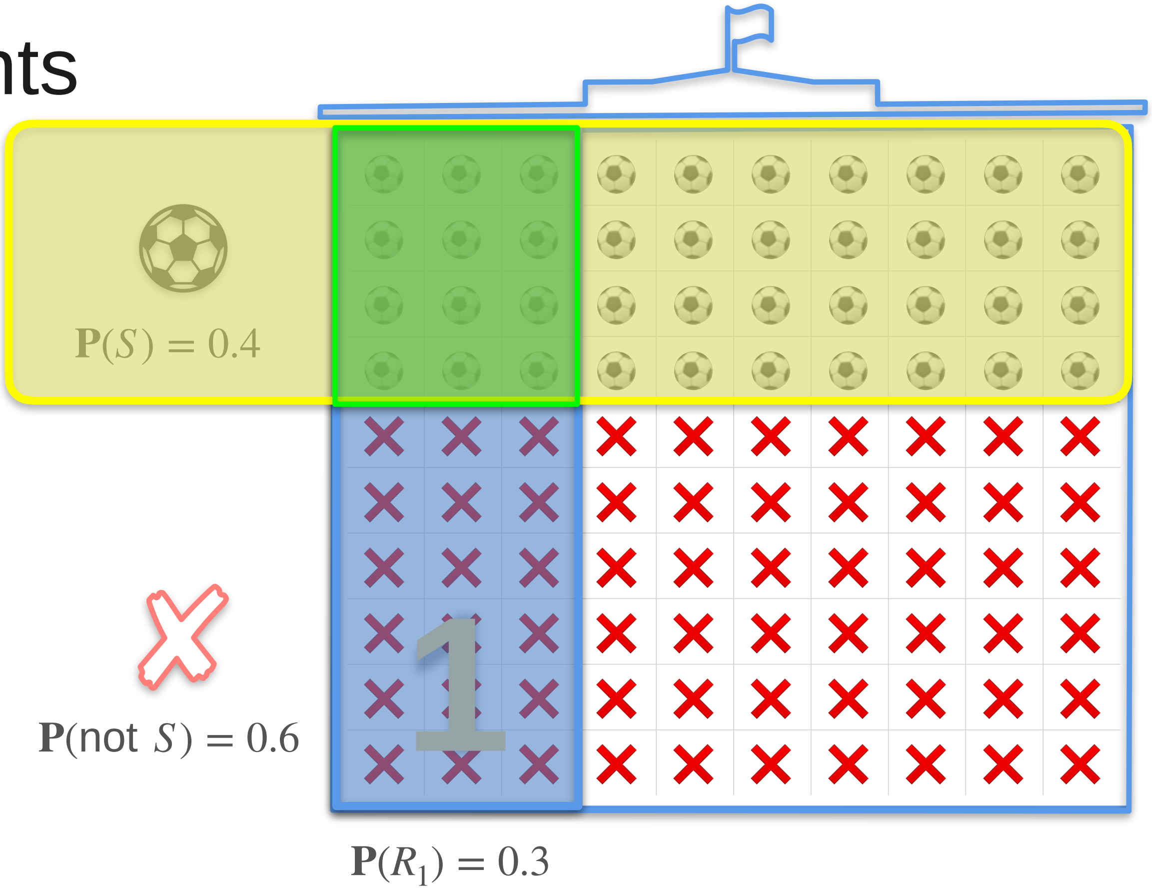
$\mathbf{P}(S \cap R_1) = \mathbf{P}(S) \bullet \mathbf{P}(R_1)$



Independent Events

P(Soccer and Room 1)

$\mathbf{P}(S \cap R_1) = \mathbf{P}(S) \bullet \mathbf{P}(R_1)$

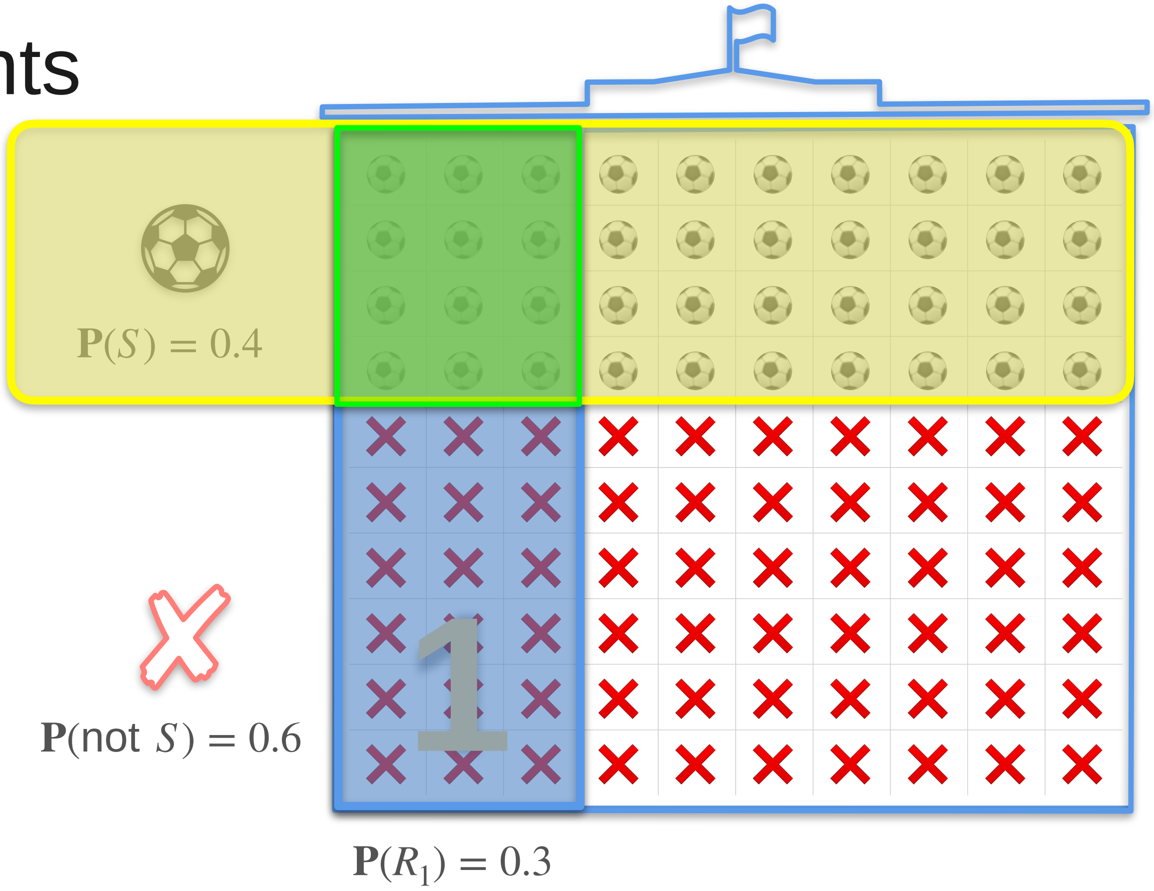


Independent Events

$\mathbf{P}$(Soccer and Room 1)

$$\mathbf{P}(S \cap R_1) = \mathbf{P}(S) \bullet \mathbf{P}(R_1)$$

$$= 0.4$$

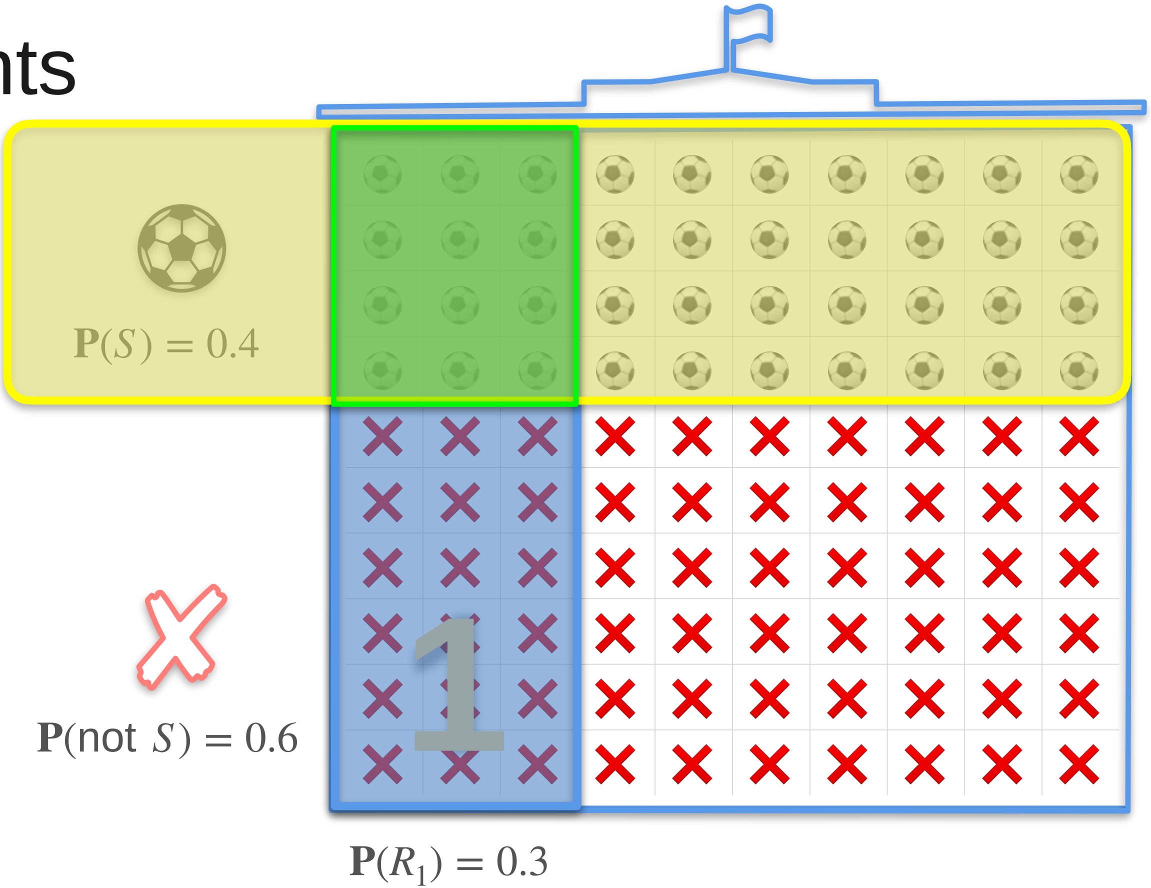


Independent Events

$\mathbf{P}$(Soccer and Room 1)

$$\mathbf{P}(S \cap R_1) = \mathbf{P}(S) \bullet \mathbf{P}(R_1)$$

$$= 0.4 \quad \bullet$$

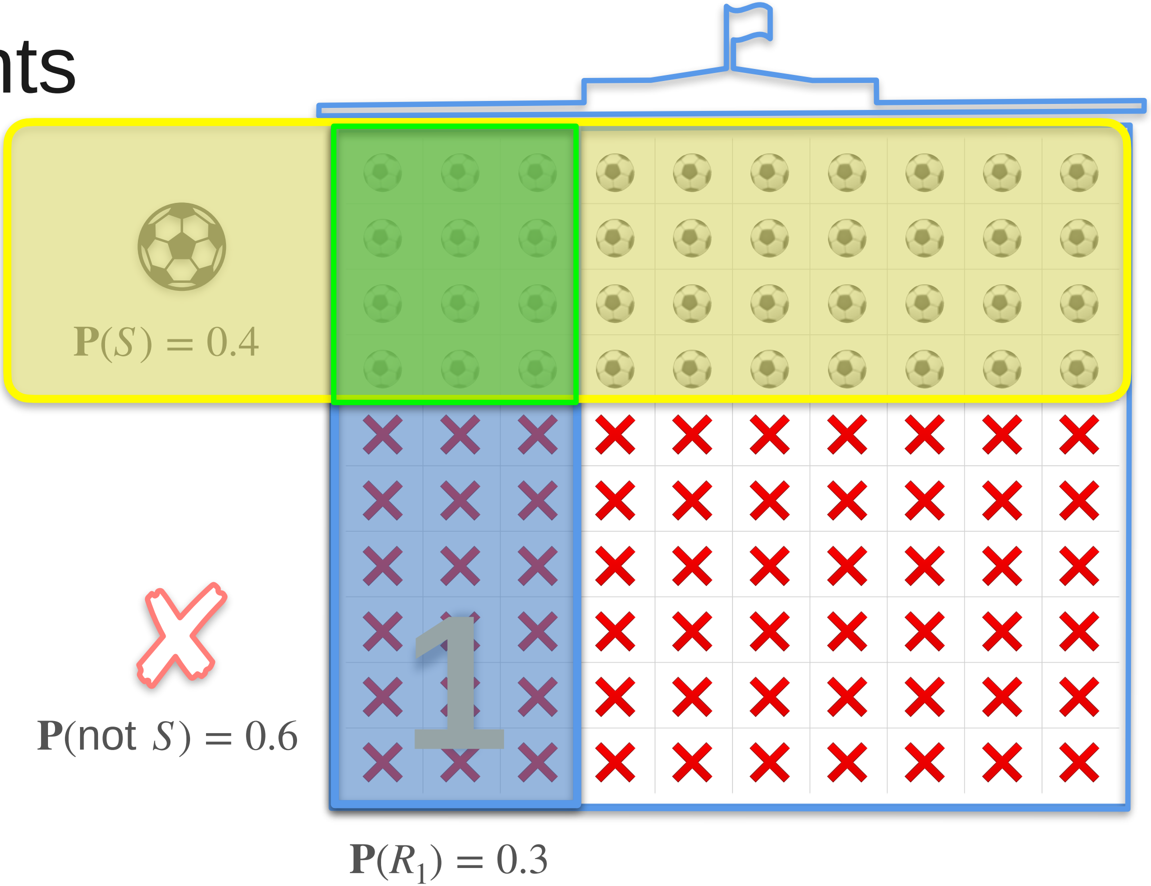


Independent Events

$\mathbf{P}$(Soccer and Room 1)

$$\mathbf{P}(S \cap R_1) = \mathbf{P}(S) \bullet \mathbf{P}(R_1)$$

$$= 0.4 \bullet 0.3$$



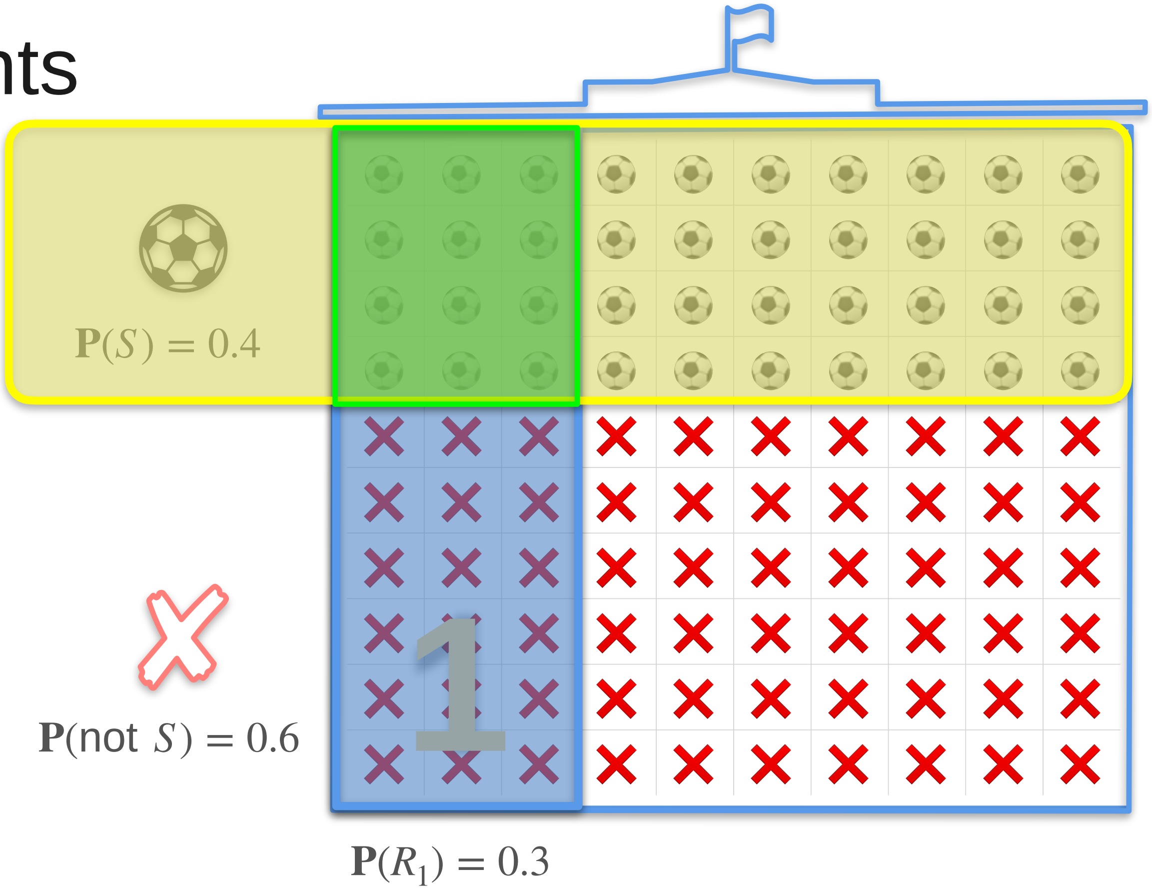
Independent Events

$\mathbf{P}$(Soccer and Room 1)

$$\mathbf{P}(S \cap R_1) = \mathbf{P}(S) \bullet \mathbf{P}(R_1)$$

$$= 0.4 \bullet 0.3$$

$$= 0.12$$



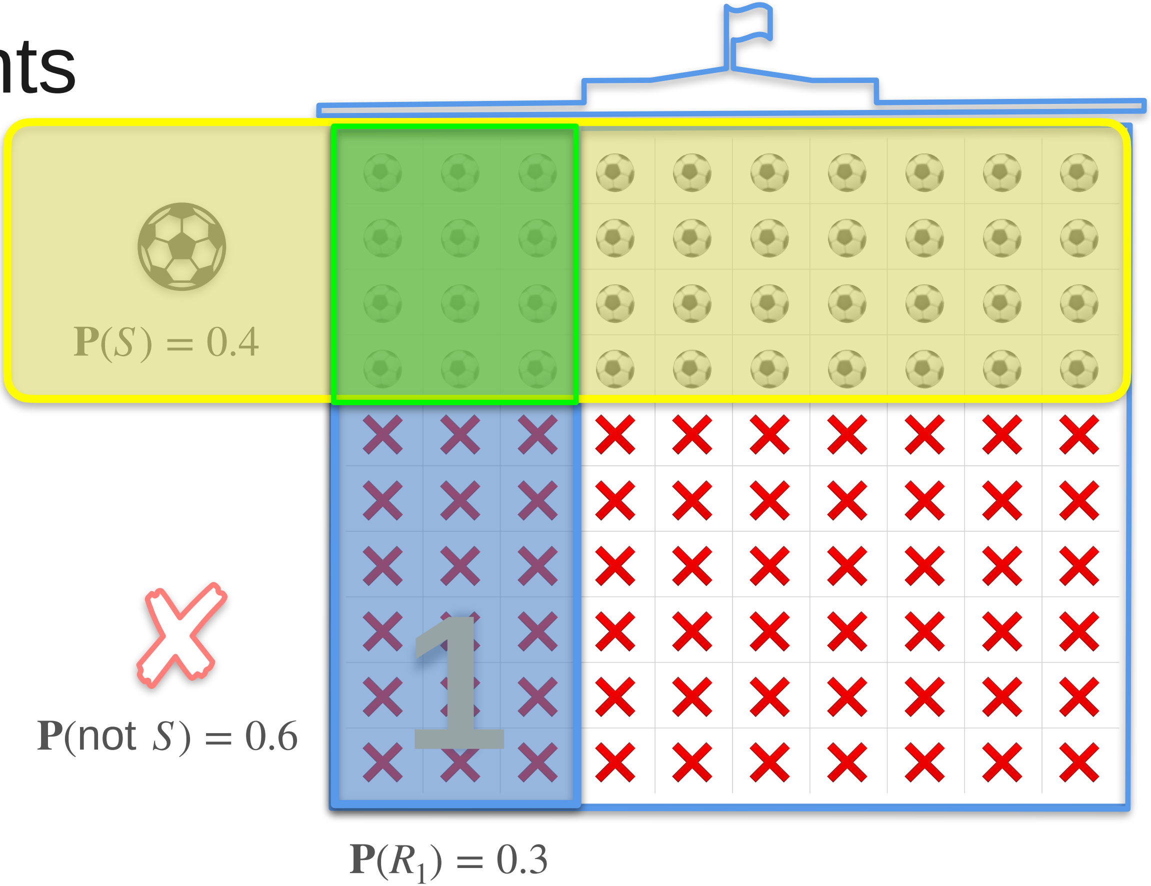
Independent Events

P(Soccer and Room 1)

$$\mathbf{P}(S \cap R_1) = \mathbf{P}(S) \bullet \mathbf{P}(R_1)$$

$$= 0.4 \bullet 0.3$$

$$= 0.12$$



Product Rule (for Independent Events)

Product Rule (for Independent Events)

$$\mathbf{P}(A \cap B) = \mathbf{P}(A) \cdot \mathbf{P}(B)$$

Independent Events: Coin Example 1

50% 50%

Independent Events: Coin Example 1

50% 50%

Independent Events: Coin Example 1

50% 50%

What is the probability of landing on heads five times?

Independent Events: Coin Example 1

50% 50%

What is the probability of landing on heads five times?

Independent Events: Coin Example 1

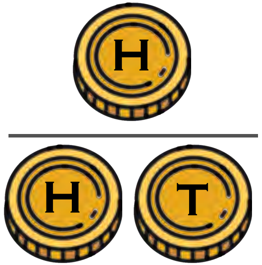
50% 50%

What is the probability of landing on heads five times?

Independent Events: Coin Example 1

50% 50%

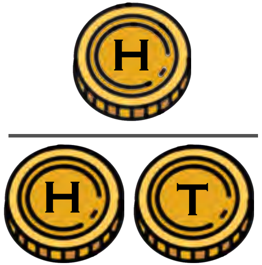
What is the probability of landing on heads five times?



Independent Events: Coin Example 1

50%   50%

What is the probability of landing on heads five times?

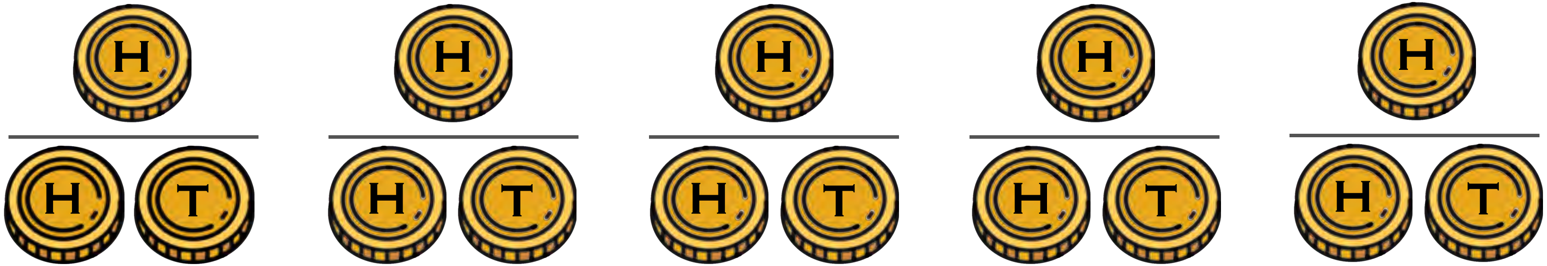


$$\frac{1}{2}$$

Independent Events: Coin Example 1

50% 50%

What is the probability of landing on heads five times?

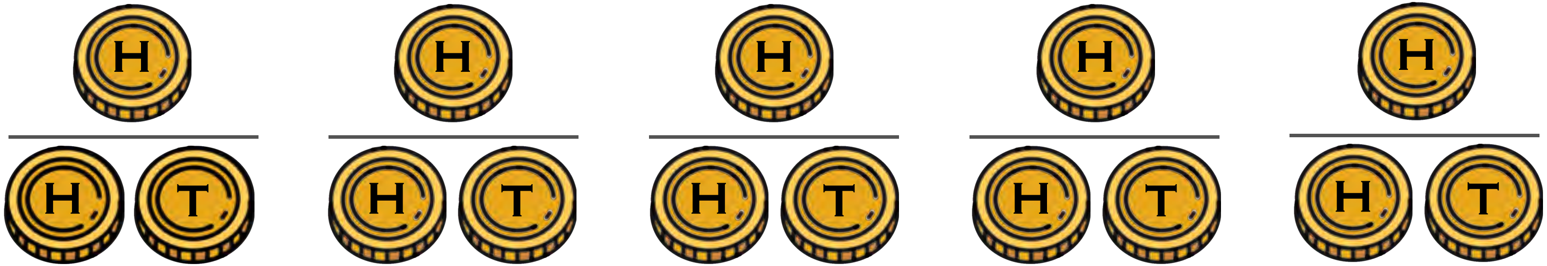


$$\frac{1}{2}$$

Independent Events: Coin Example 1

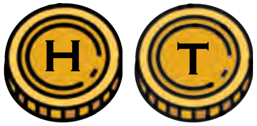
50% 50%

What is the probability of landing on heads five times?



$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$

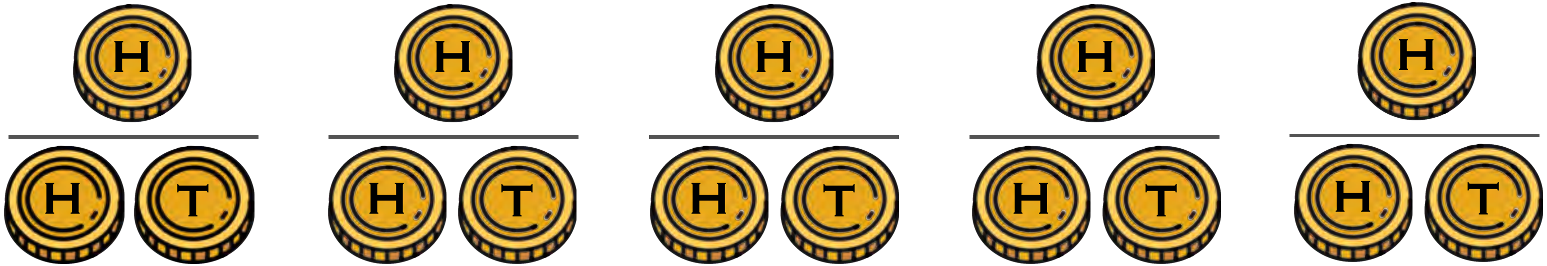
Independent Events: Coin Example 1



50% 50%

What is the probability of landing on heads five times?

P(5 heads) =



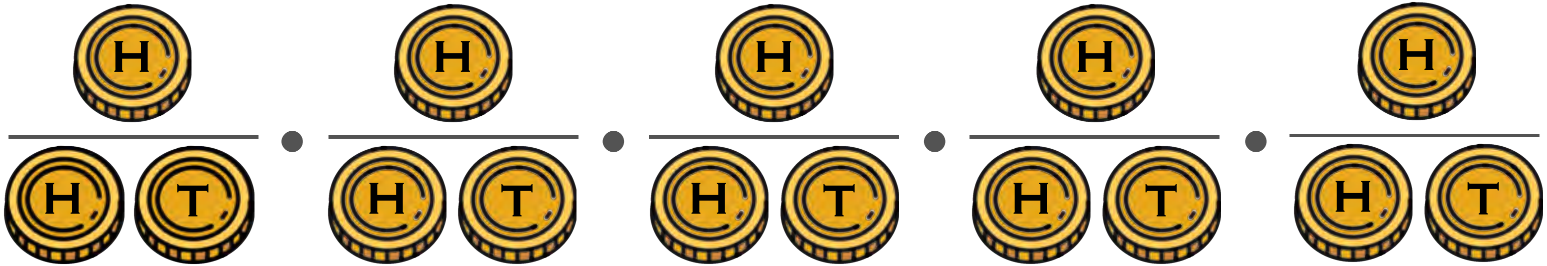
$$\frac{1}{2} \quad \frac{1}{2} \quad \frac{1}{2} \quad \frac{1}{2} \quad \frac{1}{2}$$

Independent Events: Coin Example 1

50% 50%

What is the probability of landing on heads five times?

$\mathbf{P}(5 \text{ heads}) =$

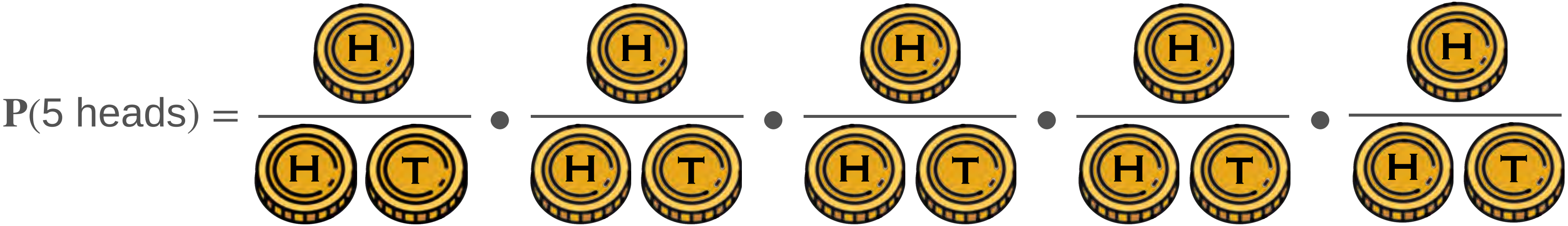


$$\frac{1}{2} \quad \frac{1}{2} \quad \frac{1}{2} \quad \frac{1}{2} \quad \frac{1}{2}$$

Independent Events: Coin Example 1

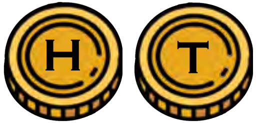
50% 50%

What is the probability of landing on heads five times?



$$\frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2}$$

Independent Events: Coin Example 2



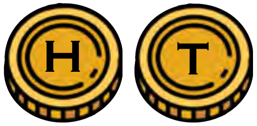
50% 50%

What is the probability of landing on heads five times?

$\mathbf{P}$(5 heads) =

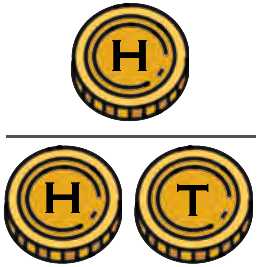
$$\frac{1}{2}$$

Independent Events: Coin Example 2



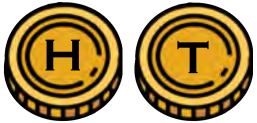
50%   50%

What is the probability of landing on heads five times?

$\mathbf{P}(\text{5 heads}) =$ ()

$$\frac{1}{2}$$

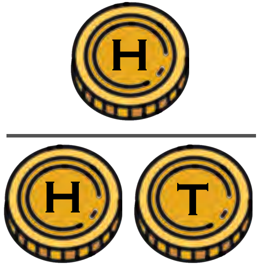
Independent Events: Coin Example 2



50% 50%

What is the probability of landing on heads five times?

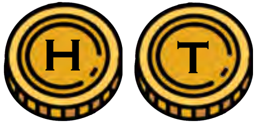
$\mathbf{P}(\text{5 heads}) = \Bigg($



$\Bigg)$

$$\frac{1}{2}$$

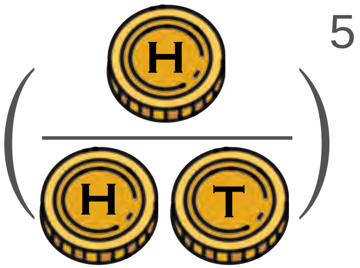
Independent Events: Coin Example 2



50% 50%

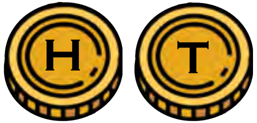
What is the probability of landing on heads five times?

$\mathbf{P}(\text{5 heads}) =$



$$\frac{1}{2}$$

Independent Events: Coin Example 2



50% 50%

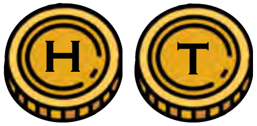
What is the probability of landing on heads five times?

P(5 heads) = (

)^5

$$\left(\frac{1}{2}\right)^5$$

Independent Events: Coin Example 2



50%   50%

What is the probability of landing on heads five times?

$$\mathbf{P}(\text{5 heads}) = \left(\frac{\text{H}}{\text{H} \quad \text{T}}\right)^5$$

$$\left(\frac{1}{2}\right)^5 = \frac{1}{32}$$

Independent Events: Dice Example 1

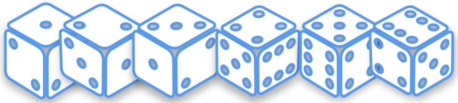
Independent Events: Dice Example 1

Independent Events: Dice Example 1

$$\mathbf{P}(6) = \frac{\qquad}{\qquad}$$

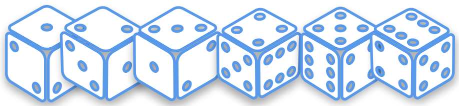
Independent Events: Dice Example 1

P(6) =



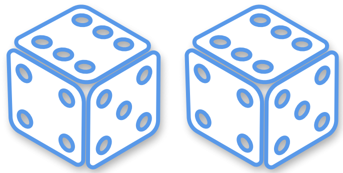
Independent Events: Dice Example 1

$$\mathbf{P}(6) = \frac{\qquad}{\qquad} = \frac{1}{6}$$

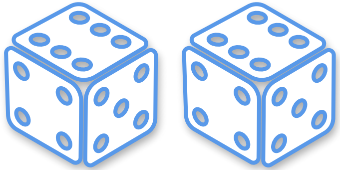


Independent Events: Dice Example 1

Independent Events: Dice Example 1

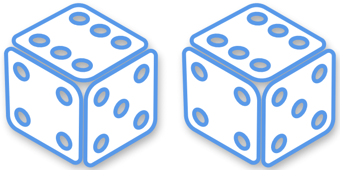


Independent Events: Dice Example 1



2 dice

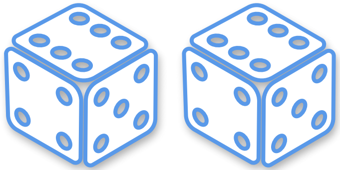
Independent Events: Dice Example 1



2 dice

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

Independent Events: Dice Example 1

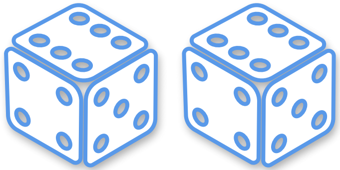


2 dice

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$$\mathbf{P}(6,6) = \underline{\hspace{6cm}}$$

Independent Events: Dice Example 1

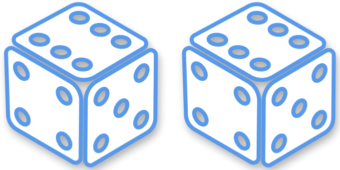


2 dice

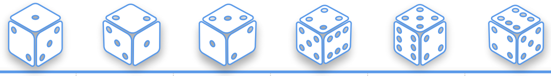
1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	$\boxed{6,6}$

$$\mathbf{P}(6,6) = \underline{\hspace{6cm}}$$

Independent Events: Dice Example 1



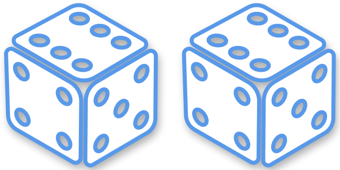
2 dice



1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	$\boxed{6,6}$

$$\mathbf{P}(6,6) = \frac{\boxed{6,6}}{\qquad\qquad}$$

Independent Events: Dice Example 1



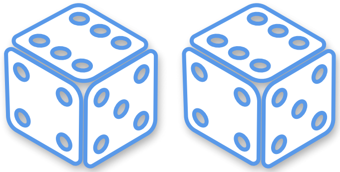
2 dice

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

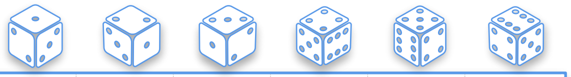
$$\mathbf{P}(6,6) = \frac{6,6}{\text{(all 36 outcomes below)}}$$

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

Independent Events: Dice Example 1



2 dice

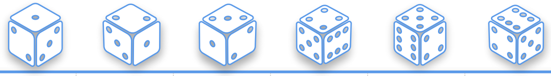


1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$$\mathbf{P}(6,6) = \frac{\boxed{6,6}}{\quad} = \frac{1}{36}$$

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

Independent Events: Dice Example 1



1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

2 dice

Independent Events: Dice Example 1

2 dice

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$$\mathbf{P}(6,6) =$$

Independent Events: Dice Example 1

2 dice

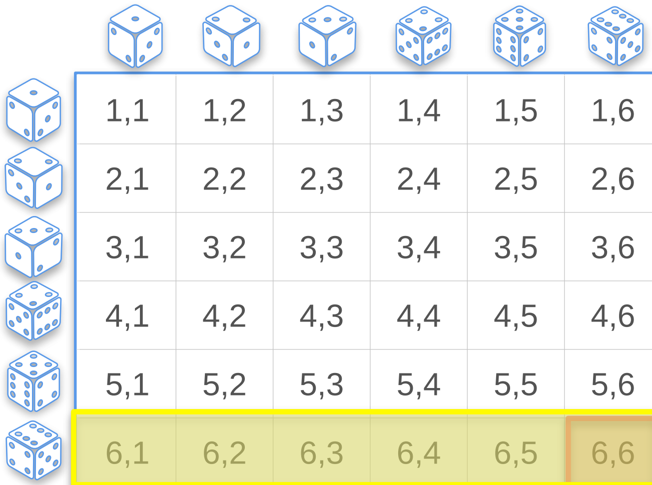
1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$\frac{1}{6}$

$\mathbf{P}(6,6) =$

Independent Events: Dice Example 1

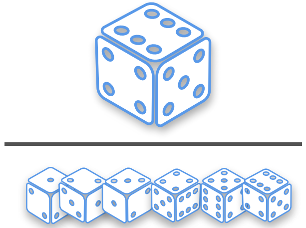
2 dice



1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$\frac{1}{6}$

$\mathbf{P}(6,6) =$



$\frac{1}{6}$

Independent Events: Dice Example 1

2 dice

$\frac{1}{6}$

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$\frac{1}{6}$

$\mathbf{P}(6,6) =$

$\frac{1}{6}$

Independent Events: Dice Example 1

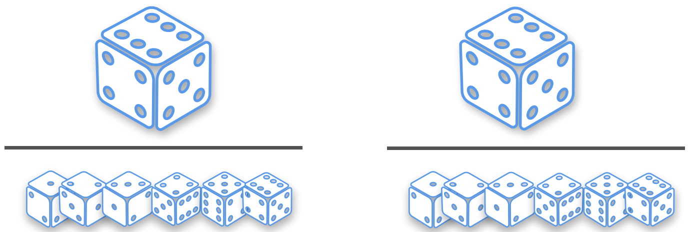
$\frac{1}{6}$

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$\frac{1}{6}$

2 dice

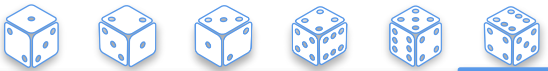
$\mathbf{P}(6,6) =$



$\frac{1}{6} \qquad \frac{1}{6}$

Independent Events: Dice Example 1

$\frac{1}{6}$

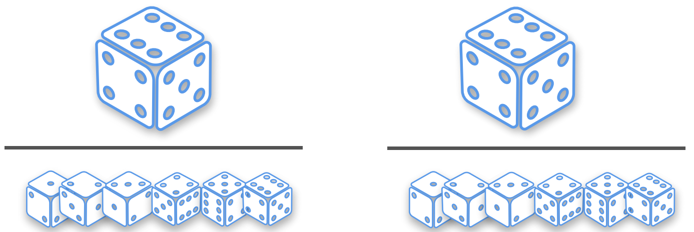


1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$\frac{1}{6}$

2 dice

$\mathbf{P}(6,6) =$



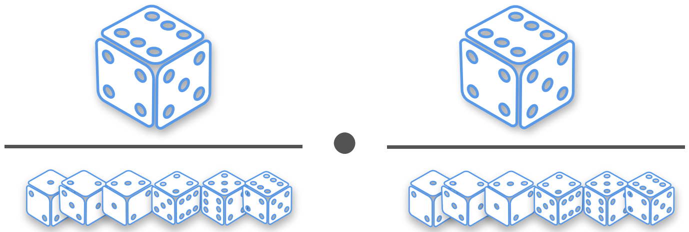
$\frac{1}{6}$ $\frac{1}{6}$

Independent Events: Dice Example 1

						$\frac{1}{6}$
	1,1	1,2	1,3	1,4	1,5	1,6
	2,1	2,2	2,3	2,4	2,5	2,6
	3,1	3,2	3,3	3,4	3,5	3,6
	4,1	4,2	4,3	4,4	4,5	4,6
	5,1	5,2	5,3	5,4	5,5	5,6
$\frac{1}{6}$	6,1	6,2	6,3	6,4	6,5	6,6

2 dice

$\mathbf{P}(6,6) =$



$$\frac{1}{6} \cdot \frac{1}{6}$$

Independent Events: Dice Example 1

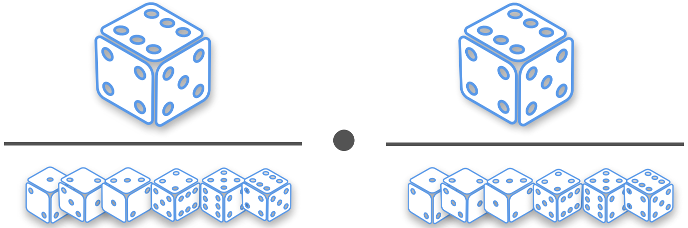
$\frac{1}{6}$

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$\frac{1}{6}$

2 dice

$\mathbf{P}(6,6) =$



$$\frac{1}{6} \bullet \frac{1}{6}$$

$$= \left(\frac{1}{6}\right)$$

Independent Events: Dice Example 1

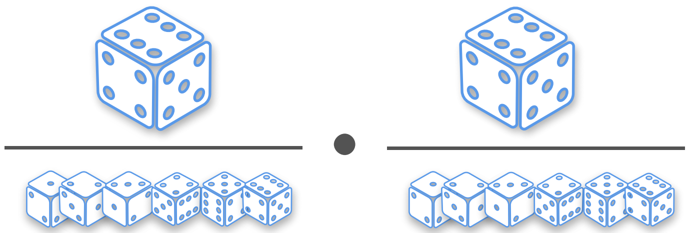
$\frac{1}{6}$

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$\frac{1}{6}$

2 dice

$\mathbf{P}(6,6) =$



$$\frac{1}{6} \cdot \frac{1}{6}$$

$$= \left(\frac{1}{6}\right)$$

Independent Events: Dice Example 1

						$\frac{1}{6}$
	1,1	1,2	1,3	1,4	1,5	1,6
	2,1	2,2	2,3	2,4	2,5	2,6
	3,1	3,2	3,3	3,4	3,5	3,6
	4,1	4,2	4,3	4,4	4,5	4,6
	5,1	5,2	5,3	5,4	5,5	5,6
$\frac{1}{6}$	6,1	6,2	6,3	6,4	6,5	6,6

2 dice

$$\mathbf{P}(6,6) = \frac{1}{6} \cdot \frac{1}{6} = \left(\frac{1}{6}\right)^2$$

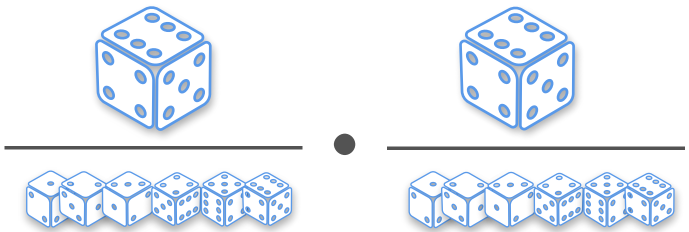
Independent Events: Dice Example 1

$\frac{1}{6}$

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$\frac{1}{6}$

2 dice

$\mathbf{P}(6,6) =$ 

$$\frac{1}{6} \bullet \frac{1}{6}$$

$$= \left(\frac{1}{6}\right)^2 = \frac{1}{36}$$

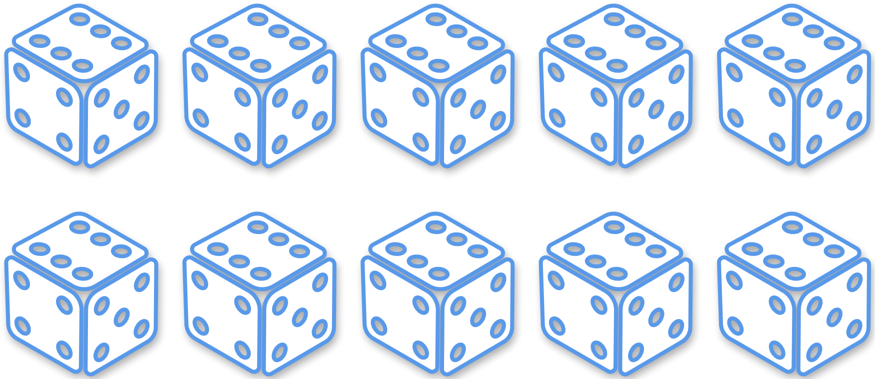
Independent Events: Dice Example 2

Independent Events: Dice Example 2

What is the probability of getting 10 sixes?

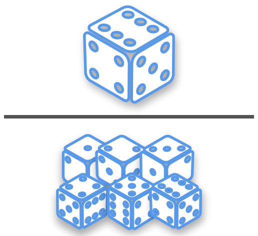
Independent Events: Dice Example 2

What is the probability of getting 10 sixes?



Independent Events: Dice Example 2

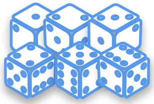
What is the probability of getting 10 sixes?



Independent Events: Dice Example 2

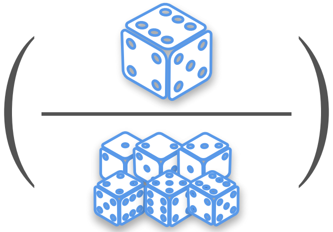
What is the probability of getting 10 sixes?

$$\mathbf{P}(\text{10 sixes}) =$$



Independent Events: Dice Example 2

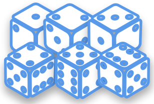
What is the probability of getting 10 sixes?

$\mathbf{P}(10 \text{ sixes}) =$ 

Independent Events: Dice Example 2

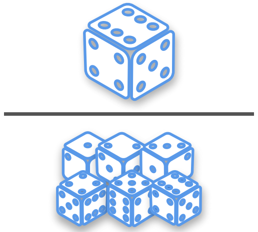
What is the probability of getting 10 sixes?

$$\mathbf{P}(\text{10 sixes}) = \left(\frac{\quad}{\quad} \right)^{10}$$



Independent Events: Dice Example 2

What is the probability of getting 10 sixes?

$\mathbf{P}(\text{10 sixes}) = \Bigg($  $\Bigg)^{10}$

$$= \left(\frac{1}{6}\right)^{10}$$

DeepLearning.AI

Introduction to probability

Birthday problem

6. The Birthday Problem

- Quiz: You have a party with 30 friends. What do you think is more likely, that there are two with the same birthday, or not?
  - Answer: Same birthday
- Calculate the probability that two people have the same birthday. Show that it's very close to 1.
- Question: How many people do you think there should be for the probability that 2 have the same birthday is 50?
  - Answer: 23
  - Show calculation

Quiz

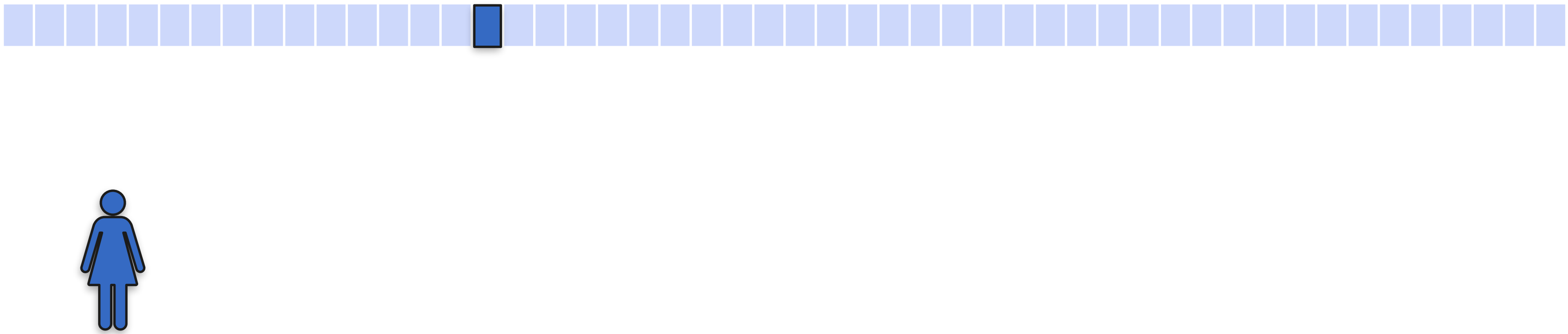
- You have 30 friends at a party. What do you think is more likely:
    - That there exist two people with the same birthday
    - That no two of them have the same birthday
- (Assume the year has 365 days, nobody has a birthday on Feb 29).

Quiz

- Answer: It’s more likely that 2 people have the same birthday.
- In fact, the probability of no two people having the same birthday is around 0.3.

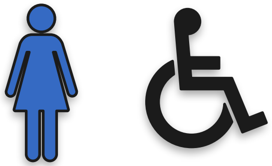
Probability That Everyone Has a Different Birthday

Probability That Everyone Has a Different Birthday



$$\frac{365}{365}$$

Probability That Everyone Has a Different Birthday

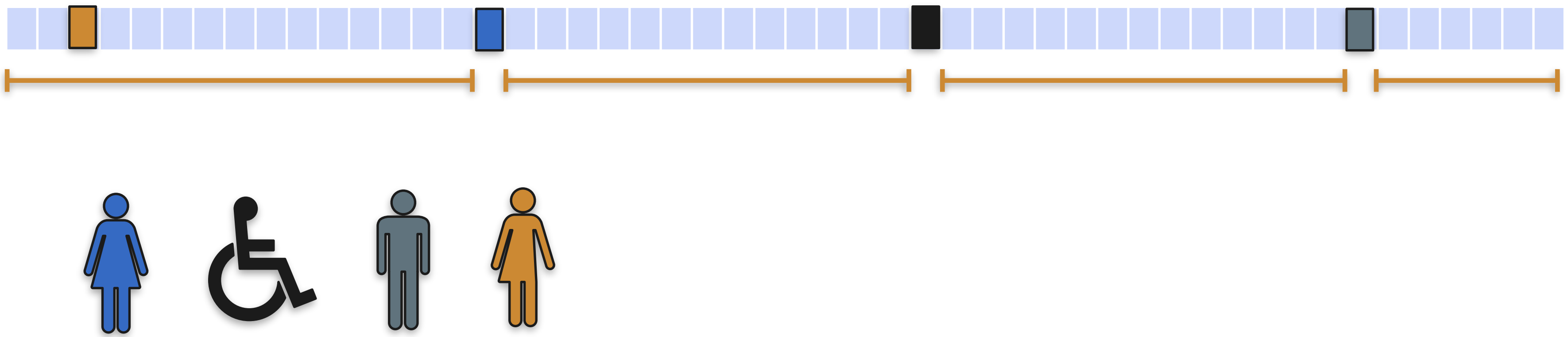


$$\frac{365}{365} \qquad \frac{364}{365}$$

Probability That Everyone Has a Different Birthday

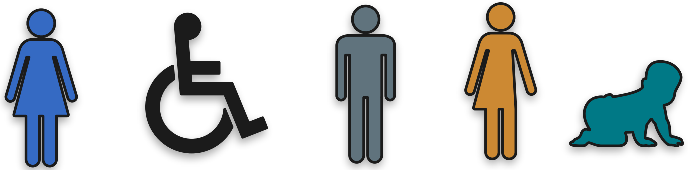
$$\frac{365}{365} \quad \frac{364}{365} \quad \frac{363}{365}$$

Probability That Everyone Has a Different Birthday



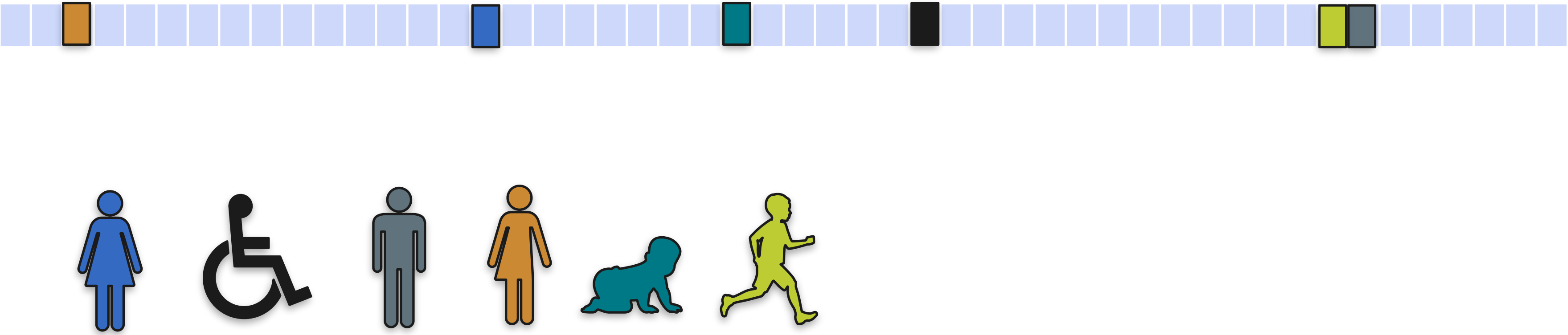
$$\frac{365}{365} \quad \frac{364}{365} \quad \frac{363}{365} \quad \frac{362}{365}$$

Probability That Everyone Has a Different Birthday



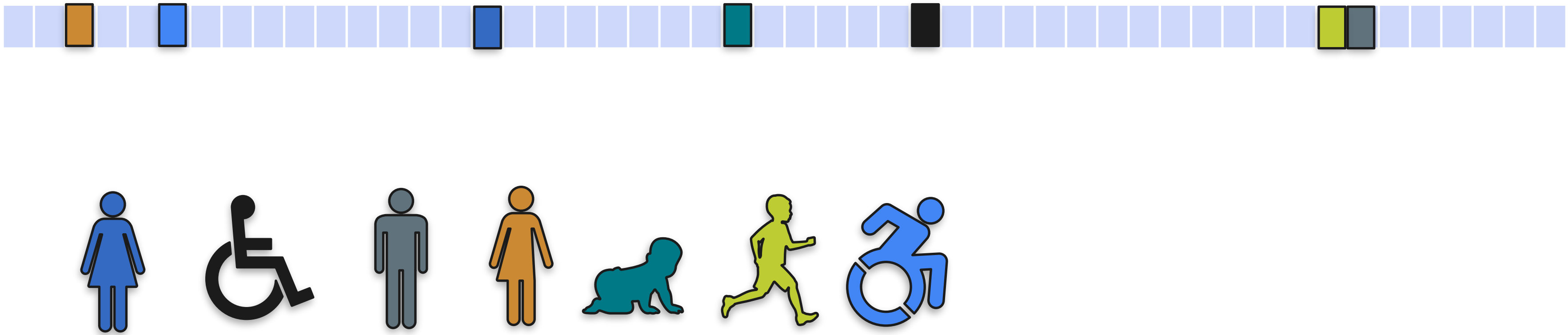
$$\frac{365}{365} \quad \frac{364}{365} \quad \frac{363}{365} \quad \frac{362}{365} \quad \frac{361}{365}$$

Probability That Everyone Has a Different Birthday



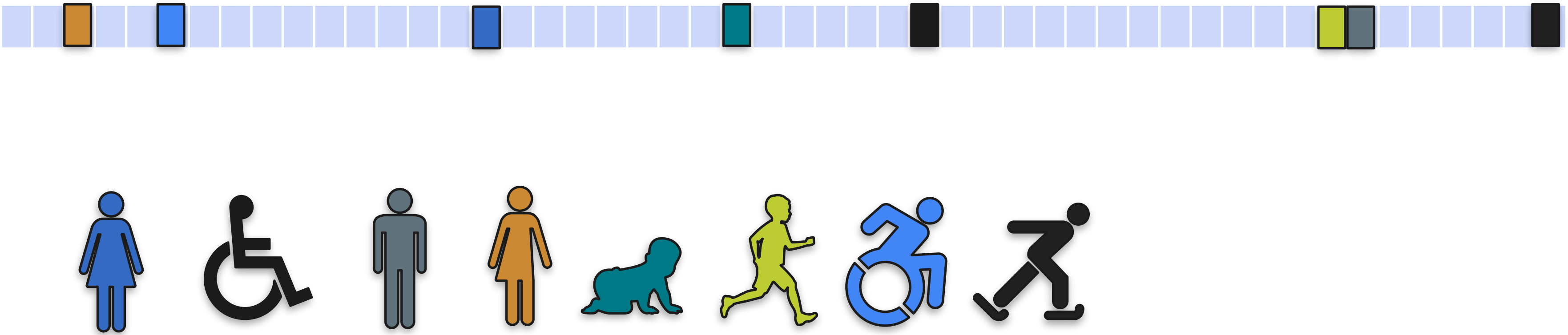
$\frac{365}{365}$ $\frac{364}{365}$ $\frac{363}{365}$ $\frac{362}{365}$ $\frac{361}{365}$ $\frac{360}{365}$

Probability That Everyone Has a Different Birthday



$\frac{365}{365}$ $\frac{364}{365}$ $\frac{363}{365}$ $\frac{362}{365}$ $\frac{361}{365}$ $\frac{360}{365}$ $\frac{359}{365}$

Probability That Everyone Has a Different Birthday



$\frac{365}{365}$ $\frac{364}{365}$ $\frac{363}{365}$ $\frac{362}{365}$ $\frac{361}{365}$ $\frac{360}{365}$ $\frac{359}{365}$ $\frac{358}{365}$