

Conditional and independent events



Decide whether events are independent or conditional, and calculate probabilities using trees, a Venn diagram, and a two-way table.

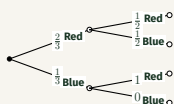
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Independent vs conditional

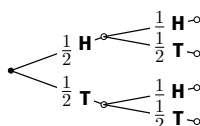
Events are **INDEPENDENT** if one does not affect the other's probability: $P(B | A) = P(B)$. Events are **CONDITIONAL** (dependent) if one changes the other's probability: $P(B | A) \neq P(B)$, read "the probability of B given A ". Without replacement usually creates dependence; with replacement usually keeps events independent.

Worked example A bag has 2 red, 1 blue counter, drawn **WITHOUT** replacement. Find $P(\text{2nd is Red} | \text{1st was Red})$.



After removing a red counter, 1 red and 1 blue remain (2 total).
 $P(\text{2nd Red} | \text{1st Red}) = \frac{1}{2}$.

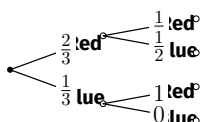
1. Two fair coins are tossed. Find $P(\text{Heads then Heads})$.



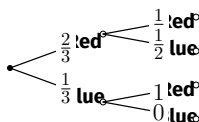
2. A die is rolled twice. Are the two rolls independent? Why?

3. What does $P(B | A)$ mean, in words?

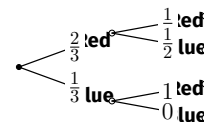
4. Bag: 2 red, 1 blue (no replacement). Find $P(\text{2nd Red} | \text{1st Red})$.



5. Using the same tree, find $P(\text{2nd Red} | \text{1st Blue})$.



6. Find $P(\text{Red then Red})$ by multiplying along the branches.



7. $P(B) = 0.5$ and $P(B | A) = 0.5$. Are A and B independent?

8. $P(B) = 0.5$ but $P(B | A) = 0.8$. Are A and B independent? Explain.

9. Why does comparing $P(B)$ to $P(B | A)$ test for independence?

Conditional and independent events (continued)

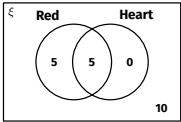


Decide whether events are independent or conditional, and calculate probabilities using trees, a Venn diagram, and a two-way table.

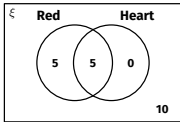
Name _____

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10. Of 20 cards, state $n(\text{Red})$ and $n(\text{Heart})$.



11. Find $P(\text{Heart})$ and $P(\text{Heart} \mid \text{Red})$. Independent?



12. Why does knowing a card is Red change the probability it's a Heart?

13. State $n(\text{Plays sport})$ and $n(\text{Tidy room})$ totals.

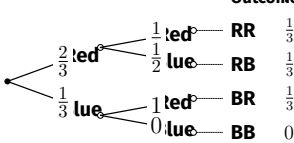
Sport/Tidy	Tidy	Not tidy	Total
Sport	15	25	40
No sport	10	50	60
Total	25	75	100

14. Find $P(\text{Tidy} \mid \text{Sport})$ vs $P(\text{Tidy})$ overall. Independent?

Sport/Tidy	Tidy	Not tidy	Total
Sport	15	25	40
No sport	10	50	60
Total	25	75	100

15. Why is a two-way table useful for spotting conditional probability?

16. Using the bag tree, find $P(\text{one Red, one Blue, either order})$.



17. "I already rolled a 6, so I'm less likely to roll one next time." Explain the error.

18. Describe one example of independent events and one of dependent (conditional) events.
