Precalc13.4

Find the probability of independent and dependent events
Identify mutually exclusive events
Find the probability of mutually exclusive events
Find the probability of inclusive events

independent events Separate outcomes

dependent events first outcome → changes 2nd

mutually exclusive

sample space

reduced sample space

inclusive events

Venn diagram

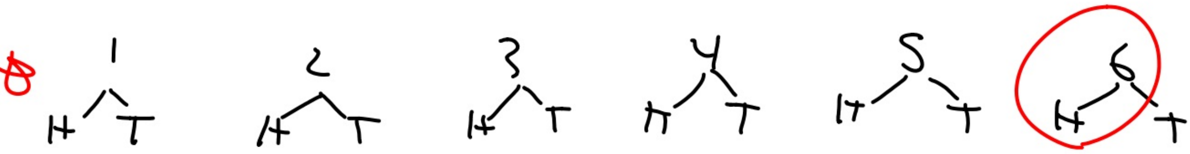
activity: red or hat?

Probability of Two Independent Events

If two events, A and B, are independent, then the probability of both events occurring is the product of each individual probability.

$$P(A \text{ and } B) = P(A) \cdot P(B)$$

$$P(6, H) = \frac{1}{6} \cdot \frac{1}{2} = \frac{1}{12}$$



Independent or dependent? (does the first choice change the options?)

1 **Using a standard deck of playing cards, find the probability of selecting a face card, replacing it in the deck, and then selecting an ace.**

$$\frac{12}{52} \cdot \frac{4}{52} = \frac{48}{2704} = \frac{3}{169}$$

2 **OCCUPATIONAL HEALTH** Statistics collected in a particular coal-mining region show that the probability that a miner will develop black lung disease is $\frac{5}{11}$. Also, the probability that a miner will develop arthritis is $\frac{1}{5}$. If one health problem does not affect the other, what is the probability that a randomly-selected miner will not develop black lung disease but will develop arthritis?

P_{BL} $\frac{5}{11}$ $1-\frac{5}{11}$

P_A $\frac{1}{5}$

$\left(\frac{6}{11}\right)\cdot\left(\frac{1}{5}\right) = \frac{6}{55}$

4 **Lenard is a contestant in a game where if he selects a blue ball or a red ball he gets an all-expenses paid Caribbean cruise. Lenard must select the ball at random from a box containing 2 blue, 3 red, 9 yellow, and 10 green balls. What is the probability that he will win the cruise?**

win $\frac{5}{24}$ not $\frac{19}{24}$

$\left.\begin{matrix} B \\ R \end{matrix}\right\}$ Cruise

5:19

2B
3R
9Y
10G
24 T

First selection changes the options for the second selection.

Probability of Two Dependent Events	If two events, A and B, are dependent, then the probability of both events occurring is the product of each individual probability. $$P(A \text{ and } B) = P(A) \cdot P(B \text{ following } A)$$

with $K \rightarrow Q$

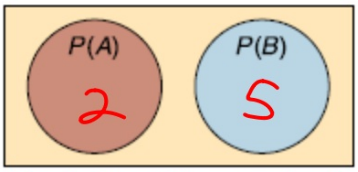
$$\frac{4}{52} \cdot \frac{4}{52} = \frac{16}{2704} = \frac{1}{169}$$

without

$$\frac{4}{52} \cdot \frac{4}{51} = \frac{16}{2652} = \frac{4}{663}$$

draw k, and then draw q
with replacement
without replacement

2 or 5
Could it be both?

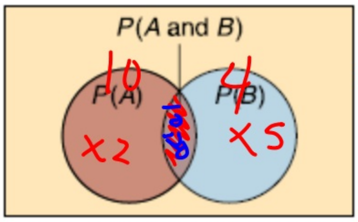


Events A and B are mutually exclusive.

1 - 20

x2 2 4 6 8 10 12 14 16 18 20

10 + 4 − 2



…ents A and B are inclusive events.

x5 5 ~~10~~ 15 ~~20~~

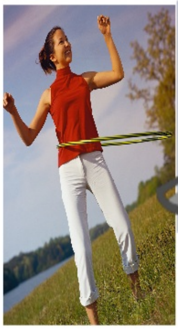
A food or a word starting with letter c

Could it be both? Did something get counted twice?

A or B (but not both)

Probability of Mutually Exclusive Events	If two events, A and B, are mutually exclusive, then the probability that either A or B occurs is the sum of their probabilities. $$P(A \text{ or } B) = P(A) + P(B)$$

(not both)

$\frac{6}{9} = \frac{2}{3}$

$\frac{1}{9} + \frac{5}{9}$

P(shoes or hat)
(can it be both?)
P(hat or red)
(can it be both?)




$\frac{5}{9} + \frac{4}{9}$

If two events, *A* and *B*, are inclusive, then the probability that either *A* or *B* occurs is the sum of their probabilities decreased by the probability of both occurring.

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

- double counted

P king or club? $= \frac{4}{52} + \frac{13}{52} - \frac{1}{52} = \frac{16}{52} = \frac{4}{13}$

100 student: senior or a girl?

13 50

$\frac{13}{100} + \frac{50}{100} - \frac{7}{100} = \frac{56}{100} = \frac{14}{25}$

$$\frac{4}{52} + \frac{4}{52} = \frac{8}{52} = \frac{2}{13}$$

P (king or ace)
P (queen or black)

$$\frac{4}{52} + \frac{26}{52} - \frac{2}{52} = \frac{28}{52} = \frac{7}{13}$$

and - both ×
or → either +
(0.0)

Did I count anything twice?

17-47 odd