

3.3: Addition Rule

$P(A \text{ or } B)$ = probability that event
A or event B occurs or
they both occur

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

Titanic Passengers

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	Men	Women	Boys	Girls	Totals
Survived	332	318	29	27	706
Died	1360	104	35	18	1517
Total	1692	422	64		2223

Is there overlap?

No

Find the probability of selecting a man or a woman

$$P(M \text{ or } W) = \frac{1692}{2223} + \frac{422}{2223} - \bigcirc$$

$$= \frac{2114}{2223} = .951$$

↓ No overlap

Titanic Passengers

	Men	Women	Boys	Girls	Totals
Survived	332	318	29	27	706
Died	1360	104	35	18	1517
Total	1692	422	64		2223

Is there
overlap?
Yes

Find the probability of selecting a woman
or someone who survived

$$P(W \text{ or } S) = P(W) + P(S) - P(W \text{ and } S)$$

$$\frac{422}{2223} + \frac{706}{2223} - \frac{318}{2223} = \frac{810}{2223} = .364$$

Titanic Passengers

	Men	Women	Boys	Girls	Totals
Survived	332	318	29	27	706
Died	1360	104	35	18	1517
Total	1692	422	64		2223

Is there overlap?

Yes

Find the probability of selecting a boy or someone who died

$$P(B \text{ or } D) = \frac{64}{2223} + \frac{1517}{2223} - \frac{35}{2223} = .695$$

$$P(B \text{ or } D) = \frac{29 + 35 + 1360 + 104 + 18}{2223}$$

Titanic Passengers

	Men	Women	Boys	Girls	Totals
Survived	332	318	29	27	706
Died	1360	104	35	18	1517
Total	1692	422	64		2223

Is there overlap?

Find the probability of selecting a man or someone who died

$$P(M \cup D) = \frac{332 + 1360 + 104 + 35 + 18}{2223}$$

$$= .832$$

Titanic Passengers

	Men	Women	Boys	Girls	Totals
Survived	332	318	29	27	706
Died	1360	104	35	18	1517
Total	1692	422	64		2223

Is there overlap?

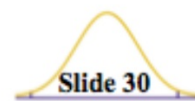
Yes

Find the probability of selecting a child or someone who did not survive.

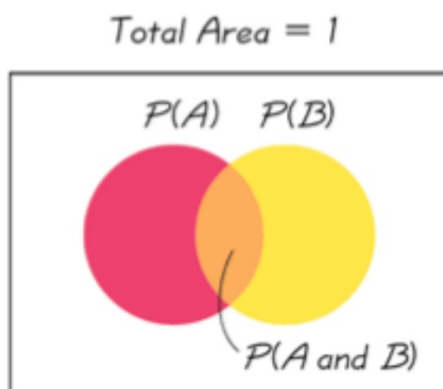
$$P(C \text{ or } D) = \frac{1573}{2223}$$

$$= .708$$

Definition



Events A and B are **disjoint** (or **mutually exclusive**) if they cannot both occur together.



**$P(A)$ and $P(\bar{A})$
are
mutually exclusive**

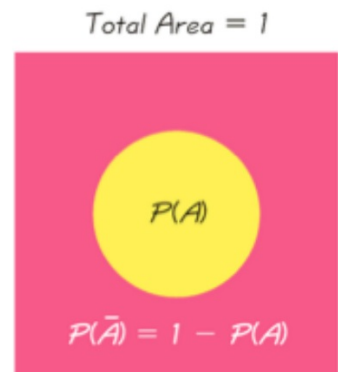
No overlap = disjoint

All simple events are either in A or \bar{A} .

$$P(A) + P(\bar{A}) = 1$$

$$P(\bar{A}) = 1 - P(A)$$

$$P(A) = 1 - P(\bar{A})$$



↑ complements

Complementary Events

- A poll showed that 61% of Americans say they believe that life exists elsewhere in the galaxy. What is the probability of randomly selecting someone NOT having that belief?

Are these events mutually exclusive?

Event A: randomly selecting a senior

Event B: randomly selecting a junior

Yes ; no student will be in
both categories .

Are these events mutually exclusive?

Event A: randomly selecting a doctor

Event B: randomly selecting a female

No, there are female doctors.

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1, 3, 7, 9, 10, 11, 12