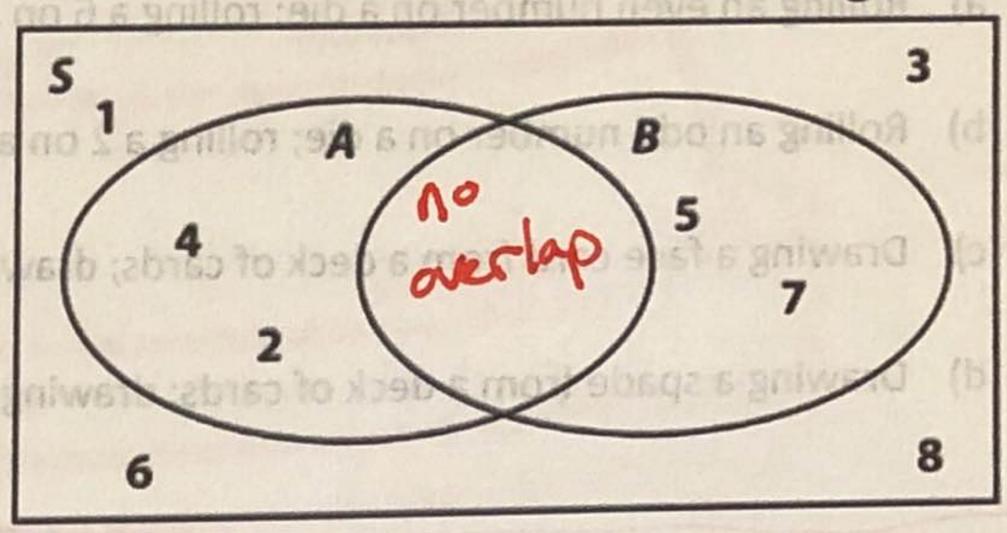
Mutually Exclusive and Inclusive Events

Mutually Exclusive Events

Situation

Roll an octahedral number cube. This number cube has 8 sides that are numbered from 1 to 8.
Let event *A* be rolling an even number less than 5.
Let event *B* be rolling an odd number greater than 4.
Let *S* be the sample space.

Diagram



Description

There are no outcomes in common.

There are no #s on the cube that fit both events.

Solution

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

even # less than 5

$$= \frac{2}{8} + \frac{2}{8} = \frac{4}{8} = \frac{1}{2}$$

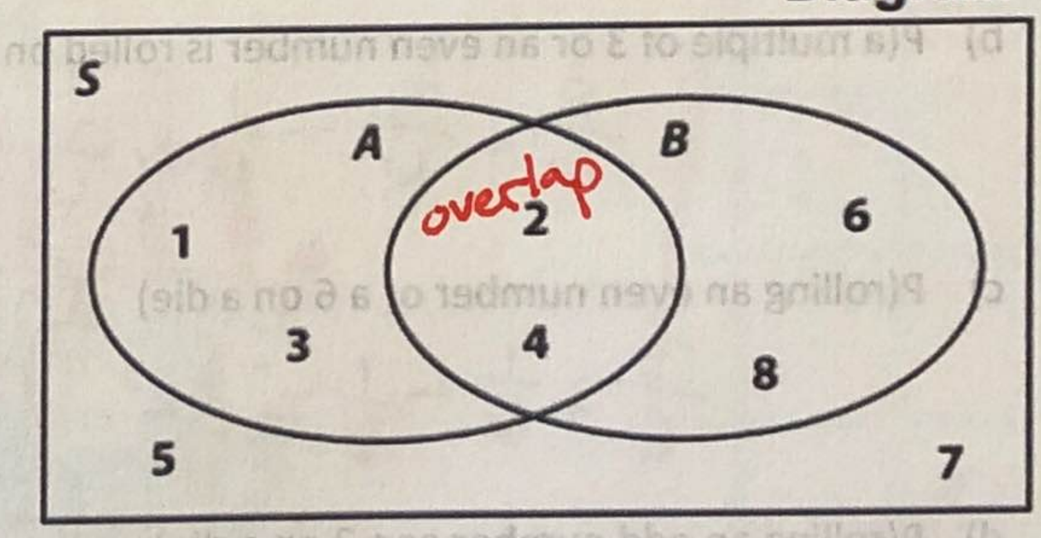
odd # greater than 4

Overlapping (Inclusive) Events

Situation

Roll an octahedral number cube. This number cube has 8 sides that are numbered from 1 to 8.
Let event *A* be rolling a number less than 5.
Let event *B* be rolling an even number.
Let *S* be the sample space.

Diagram



Description

There is at least one outcome in common.

There are 2 sides that fit both events, so subtract the overlap.

Solution

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

$$= \frac{4}{8} + \frac{4}{8} - \frac{2}{8} = \frac{6}{8} = \frac{3}{4}$$

less than 5 | even | overlap

- If two events are **mutually exclusive**, then they **cannot** occur at the same time.
- If two events are **mutually inclusive**, then they **can** occur at the same time.

AFM Unit 6 Lesson 5

Mutually Exclusive and Inclusive Events

Example 1: Determine whether the two events are mutually exclusive or mutually inclusive.

a) Rolling an even number on a die; rolling a 6 on a die Inclusive; 6 is also even

b) Rolling an odd number on a die; rolling a 2 on a die Exclusive; no odd # that's also 2

c) Drawing a face card from a deck of cards; drawing a 5 from a deck of cards Exclusive; no 5 that's a face card

d) Drawing a spade from a deck of cards; drawing a 7 from a deck of cards Inclusive; there's a 7 of spades

The Addition Rule tells you how to find the probability that A or B occurs.

- Mutually Exclusive: $P(A \text{ or } B) = P(A) + P(B)$
- Mutually Inclusive: $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$ ← overlap

Example 2: Use the appropriate version of the Addition Rule to find each probability.

a) P(a multiple of 5 or an even number is rolled on a die) Exclusive

$\frac{1}{6} + \frac{3}{6} = \frac{4}{6} = .\overline{6} = 66.7\%$

1 2 3 4 5 6
5 is a multiple of 5
3 even #s

b) P(a multiple of 3 or an even number is rolled on a die) Inclusive

$\frac{2}{6} + \frac{3}{6} - \frac{1}{6} = \frac{4}{6} = .\overline{6} = 66.7\%$

1 2 3 4 5 6
3 and 6 are multiples of 3; 3 evens; 6 is both

c) P(rolling an even number or a 6 on a die) Inclusive

$\frac{3}{6} + \frac{1}{6} - \frac{1}{6} = \frac{3}{6} = .5 = 50\%$

6 is both

d) P(rolling an odd number or a 2 on a die) Exclusive

$\frac{3}{6} + \frac{1}{6} = \frac{4}{6} = .\overline{6} = 66.7\%$

no overlap

e) P(drawing a spade or a 7 from a deck of cards) Inclusive

$\frac{13}{52} + \frac{4}{52} - \frac{1}{52} = \frac{16}{52} = .308 = 30.8\%$

13 spades, 4 7s
there is 1 7 of spades