3 – 3
Addition Rule

Definition

❖ **Compound Event**

Any event combining two or more simple events

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❖ **Notation**

P(A or B) = P (event A occurs or event B occurs or they both occur)

Compound Event

General Rule

When finding the probability that event A occurs or event B occurs, find the total number of ways A can occur and the number of ways B can occur, but find the total in such a way that no outcome is counted more than once.

Compound Event

Formal Addition Rule

P(A or B) = P(A) + P(B) - P(A and B)

where P(A and B) denotes the probability that A and B both occur at the same time.

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Intuitive Addition Rule

To find P(A or B), find the sum of the number of ways event A can occur and the number of ways event B can occur, adding in such a way that every outcome is counted only once. P(A or B) is equal to that sum, divided by the total number of outcomes.

2

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

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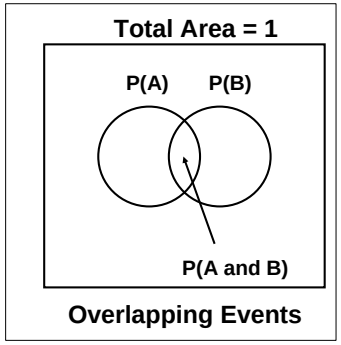

Overlapping Events

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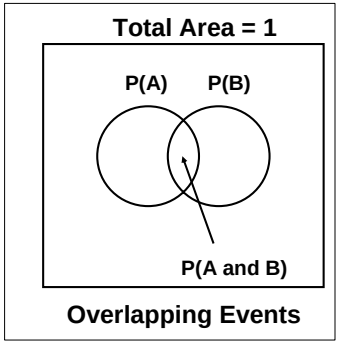

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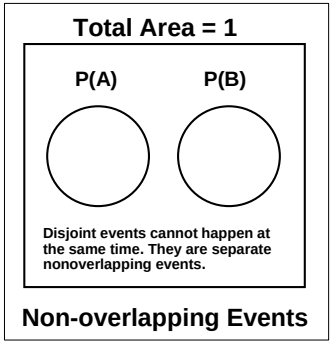
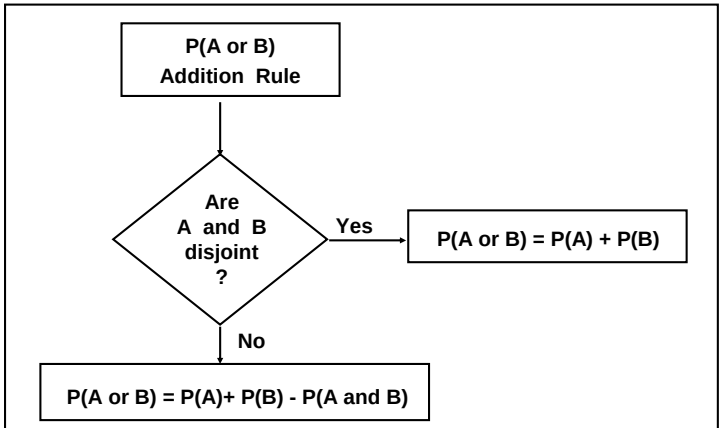
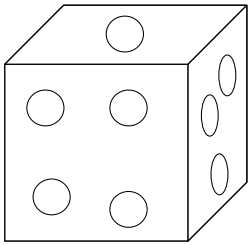


Non-overlapping Events

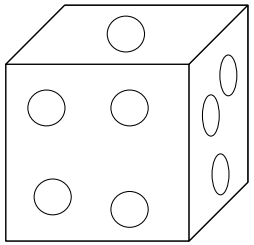
Applying the Addition Rule



3



A = Green ball
B = Blue ball
} disjoint events



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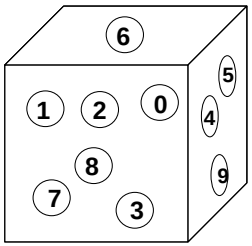
} disjoint events

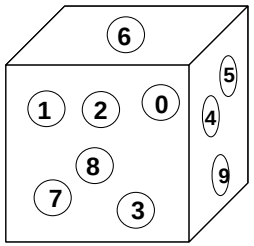
$$P(A \text{ or } B) = P(A) + P(B) = \frac{4}{8} + \frac{1}{8} = \frac{5}{8}$$



A = Even number

B = Number <u>greater than</u> 5

counted twice



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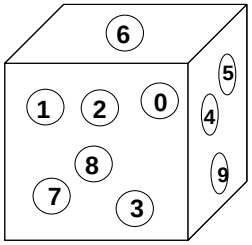
4



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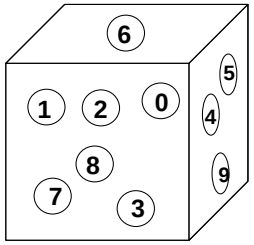

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<u>Overlapping events</u>; some counted twice

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B) = \frac{5}{10} + \frac{4}{10} - \frac{2}{10} = \frac{7}{10}$$

0 2 4 6 8 — 6 7 8 9 — 6 & 8

counted twice

Contingency Table

	Men	Women	Boys	Girls	Totals
Survived	332	318	29	27	706
Died	1360	104	35	18	1517
Total	1692	422	64	45	2223

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Example: In a test of the allergy drug Seldane, 49 of 781 users experienced headaches, 49 of 665 placebo users experienced headaches, and 24 of 626 people in the control group experienced headaches.

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Rules of Complementary Events

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

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Venn Diagram for the Complement of Event A