Connexions module: m16848

Probability Topics: Venn Diagrams (optional)*

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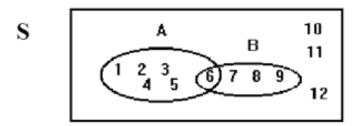
Abstract

This module introduces Venn diagrams as a method for solving some probability problems. This module is included in the Elementary Statistics textbook/collection as an optional lesson.

A **Venn diagram** is a picture that represents the outcomes of an experiment. It generally consists of a box that represents the sample space S together with circles or ovals. The circles or ovals represent events.

Example 1

Suppose an experiment has the outcomes 1, 2, 3, ..., 12 where each outcome has an equal chance of occurring. Let event $A = \{1, 2, 3, 4, 5, 6\}$ and event $B = \{6, 7, 8, 9\}$. Then A AND B = $\{6\}$ and A OR B = $\{1, 2, 3, 4, 5, 6, 7, 8, 9\}$. The Venn diagram is as follows:



Example 2

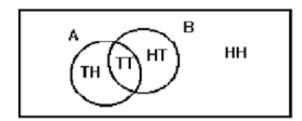
Flip 2 fair coins. Let A = tails on the first coin. Let B = tails on the second coin. Then $A = \{\text{TT}, \text{TH}\}$ and $B = \{\text{TT}, \text{HT}\}$. Therefore, A AND B = $\{\text{TT}\}$. A OR B = $\{\text{TH}, \text{TT}, \text{HT}\}$. The sample space when you flip two fair coins is $S = \{\text{HH}, \text{HT}, \text{TH}, \text{TT}\}$. The outcome HH is in neither A nor B. The Venn diagram is as follows:

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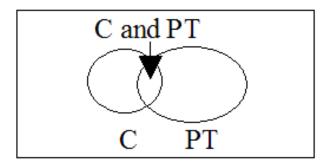
S



Example 3

Forty percent of the students at a local college belong to a club and 50% work part time. Five **percent** of the students work part time and belong to a club. Draw a Venn diagram showing the relationships. Let C = student belongs to a club and PT = student works part time.





If a student is selected at random find

- The probability that the student belongs to a club. P(C) = 0.40.
- The probability that the student works part time. P(PT) = 0.50.
- The probability that the student belongs to a club AND works part time. P(C AND PT) = 0.05
- The probability that the student belongs to a club given that the student works part time.

$$P(C|PT) = \frac{P(C \text{ AND } PT)}{P(PT)} = \frac{0.05}{0.50} = 0.1$$
 (1)

• The probability that the student belongs to a club **OR** works part time.

$$P(C \text{ OR PT}) = P(C) + P(PT) - P(C \text{ AND PT}) = 0.40 + 0.50 - 0.05 = 0.85$$
 (2)

Glossary

Definition 1: Venn Diagram

The visual representation of a sample space and events in the form of circles or ovals showing their intersections.