Basic Probability Formulas

Complementary events: The complement of event A is everything not in A. Complementary events are mutually exclusive events and together make up the sample space. The probability of the sample space is one.

Independent events: The occurrence of any one of the events does not affect the probabilities of the occurrences of the other events. Events A and B are independent if probability of A given B equals probability of A.

Dependent events (or non-independent events): Events that are not independent, i.e., P(A given B) ≠ P(A).

Mutually exclusive events (or disjoint events): If event A occurs, then event B cannot occur, and conversely.

De Morgan's Rule (one form): Via a double complement, A or B = $(A^c \text{ and } B^c)^c$ = "not [(not A) and (not B)]". For example, "I want A, B, or both to work" (Reliability) equates to "I do not want both A and B not to work" (Safety).

Event	**Details**	**Formula** (from English to mathematical operations)
A	Probability of A, **P(A)**	**P(A) is at or between zero and one: $0 \le P(A) \le 1$**
not A, A^c	A^c is the complement of A	**Probability of not A = $P(A^c)$ = 1 - P(A)**
A and B	A and B are independent events	**P(A and B) = P(A)*P(B)**
	A and B are dependent events	**P(A and B) = P(A)*P(B | A) = P(B)*P(A | B)** as 2 forms
	A and B are mutually exclusive events	**P(A and B) = 0**
A or B	A and B are independent events	**P(A or B) = P(A) + P(B) - P(A)*P(B)** conveniently expands to **= 1 - [1 - P(A)]*[1 - P(B)]** or is obtained from De Morgan's Rule
	A and B are dependent events	**P(A or B) = P(A) + P(B) - P(A)*P(B | A)** as 1 of 2 forms
	A and B are mutually exclusive events	**P(A or B) = P(A) + P(B)**
A given B, **A | B**	Conditional: outcome of A given B has occurred	**P(A given B) = P(A | B) = P(A)*P(B | A) / P(B)** [Bayes' Thm] To make this formula, solve the 2 forms in "A and B" for P(A | B)

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