

PROBABILITY

Conceptual Framework

Example: Outcomes of 500 interviews to study opinions of residents of a certain city about building a prison.

Area of City	For	Against	Empirical Probability	Total
A	100	25	0.80	125
B	115	10	0.92	125
D	50	75	0.40	125
E	35	90	0.28	125
Total	300	200		500

Def: Sample Space—set of all possible outcomes

Def: Event—Outcome of interest

Probability of an Event—Relative frequency of the event over a large number of trials

Example: Probability of an adult male age 40-49 years having a heart attack in next 6 years is 0.003

Properties:

1. Let E = some event

$$0 \leq \Pr(E) \leq 1$$

2. If A and B are two events that cannot occur at the same time,

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

Therefore, events A and B are Mutually Exclusive

Example: Let A = Type A Blood
 Let B = Type O Blood

$$\Pr(A) = 0.3$$

$$\Pr(B) = 0.4$$

$$\Pr(A \text{ or } B) = 0.3 + 0.4 = 0.7$$

Def: Union— $A \cup B =$ Probability A or B or both occurs

Def: Intersection— $A \cap B =$ Probability A and B both occur

Def: Complement-- $\bar{A} =$ Probability A does not occur

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

Def: Independent—Two events are independent if

$$\Pr(A \cap B) = \Pr(A) * \Pr(B)$$

Def: Dependent—Two events are dependent if

$$\Pr(A \cap B) \neq \Pr(A) * \Pr(B)$$