Probability

Addition Rule

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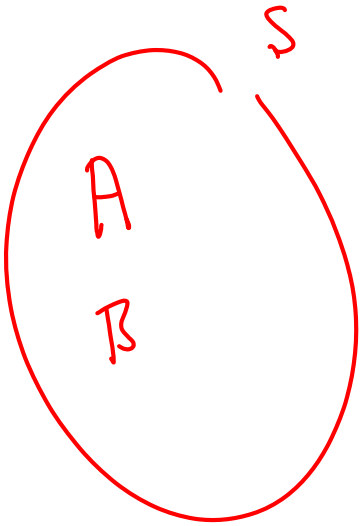

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

mutually exclusive

$$P(A \cup B) = P(A) + P(B)$$

Example

- An extrusion die (اسطمبة البثق) is used to produce aluminum rods. Specifications are given for the **length** and the **diameter** of the rods. For each rod, the **length** is classified as **too short**, **too long**, or **OK**, and the **diameter** is classified as **too thin**, **too thick**, or **OK**. In a population of **1000** rods, the number of rods in each class is as follows:

	Diameter		
Length	**Too Thin**	**OK**	**Too Thick**
Too Short	10	3	5
OK	38	900	4
Too Long	2	25	13

A rod is sampled at random from this population. **What is the probability that it is too short**?

Example

	Diameter		
Length	Too Thin	OK	Too Thick
Too Short	10	3	5
OK	38	900	4
Too Long	2	25	13

A rod is sampled at random from this population. **What is the probability that it is too short**?

$$P(\text{too short}) = \frac{10+3+5}{1000}$$

$$= \frac{18}{1000}$$

Addition Rule

- If A and B are mutually exclusive events, then P(AU B) = P(A)+ P(B).
- This rule can be generalized to cover the case where A and B are not mutually exclusive.

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

Addition Rule

- Refer to Example above. If a rod is sampled at random, what is the probability that it is either too short or too thick?

Length	Diameter: Too Thin	OK	Too Thick
Too Short	10	3	5
OK	38	900	4
Too Long	2	25	13

too short = 18

too thick = 5+4+13 = 22

Event = 18 + 22 − 5 = 35

$$P(\text{too short or too thick}) = \frac{35}{1000}$$

$$P(\text{too short or too thick}) = P(\text{too short}) + P(\text{too thick}) - P(\text{too short} \cap \text{too thick})$$

$$= \frac{18}{1000} + \frac{22}{1000} - \frac{5}{1000}$$

$$= 35/1000$$

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

mutual exclusive

$$= 0$$