

Probability

Addition Rule

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| Example

- An extrusion die (**اسطمة 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:

Length	Diameter		
	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

Length	Diameter		
	Too Thin	OK	Too Thick
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A rod is sampled at random from this population. **What is the probability that it is too short?**

| Example

- We can think of each of the 1000 rods as an outcome in a sample space. Each of the 1000 outcomes is equally likely. We'll solve the problem by counting the number of outcomes that correspond to the event. The number of rods that are too short is $10 + 3 + 5 = 18$. Since the total number of rods is 1000,
- $P(\text{too short}) = 18 / 1000$

| Addition Rule

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

| 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

| Addition Rule

- First we'll solve this problem by counting the number of outcomes that correspond to the event. In the following table the numbers of rods that are too thick are circled, and the numbers of rods that are too short have rectangles around them. **Note that there are 5 rods that are both too short and too thick.**

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

| References

- Understanding Boxplots <https://towardsdatascience.com/understanding-boxplots-5e2df7bcbd51>
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