

Probability

| Basic Ideas - Example

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| Example

- An electrical engineer has on hand **two boxes of resistors**, with **four** resistors in each box. The resistors in the first box are labeled **10 Ω** (ohms), but in fact their resistances are **9, 10, 11, and 12 Ω** . The resistors in the second box are labeled **20 Ω** , but in fact their resistances are **18, 19, 20, and 21 Ω** . The engineer chooses one resistor from each box and determines the resistance of each.
- Let **A** be the event that the **first resistor has a resistance greater than 10**, let **B** be the event that the **second resistor has a resistance less than 19**, and let **C** be the event that the **sum of the resistances is equal to 28**.
- Find a **sample space** for this experiment, and specify the subsets corresponding to the events **A, B, and C**.

| Example

$$\mathcal{S} = \{(9, 18), (9, 19), (9, 20), (9, 21), (10, 18), (10, 19), (10, 20), (10, 21), \\ (11, 18), (11, 19), (11, 20), (11, 21), (12, 18), (12, 19), (12, 20), (12, 21)\}$$

The events A , B , and C are given by

$$A = \{(11, 18), (11, 19), (11, 20), (11, 21), (12, 18), (12, 19), (12, 20), (12, 21)\}$$

$$B = \{(9, 18), (10, 18), (11, 18), (12, 18)\}$$

$$C = \{(9, 19), (10, 18)\}$$

| Example

When the number of pumps in use at each of two six-pump gas stations is observed, there are 49 possible outcomes, so there are 49 simple events: $E_1 = \{(0, 0)\}$, $E_2 = \{(0, 1)\}$, $\dots$, $E_{49} = \{(6, 6)\}$. Examples of compound events are

$A = \{(0, 0), (1, 1), (2, 2), (3, 3), (4, 4), (5, 5), (6, 6)\}$ = the event that the number of pumps in use is the same for both stations

$B = \{(0, 4), (1, 3), (2, 2), (3, 1), (4, 0)\}$ = the event that the total number of pumps in use is four

$C = \{(0, 0), (0, 1), (1, 0), (1, 1)\}$ = the event that at most one pump is in use at each station



| References

- Understanding Boxplots <https://towardsdatascience.com/understanding-boxplots-5e2df7bcbd51>
- What does a box plot tell you?
<https://www.simplypsychology.org/boxplots.html>
- Statistics for Engineers and Scientists, Fourth Edition, William Navidi
Colorado School of Mines
- Khan Academy
<https://www.khanacademy.org/math/cc-sixth-grade-math/cc-6th-data-statistics/cc-6th-box-whisker-plots/v/constructing-a-box-and-whisker-plot>