

W01 - Homework

Events and outcomes

01

✍ Sample space - roll a die, flip a coin

A normal 6-sided die is cast, and then a coin is flipped. All results are recorded.

- (a) Define a sample space for this experiment.
- (b) How many possible *events* are there?

02

✍ Sample space - flip a coin then cast a die

A normal 6-sided die is cast. If the result is even, two coins are then flipped; if the result is odd, one coin is then flipped. All results are recorded.

- (a) Define a sample space for this experiment.
- (b) How many possible *events* are there?

03

✍ Events - descriptions to sets

You are modeling quality assurance for cars coming off an assembly line. They are either good (G) or broken (B). You watch 4 cars come off and record their status as a sequence of these letters, for example 'GGBG'.

Determine the *sets* defined by the events having the following descriptions:

- (a) "third car is broken"
- (b) "all cars have the same status"
- (c) "at least one car is broken"
- (d) "no consecutive cars have the same status"

Probability models

04

✍ Venn diagrams - sets rules and Kolmogorov additivity

Suppose we know three probabilities of events: $P[A] = 0.4$, $P[B] = 0.3$, and $P[A \cap B] = 0.1$.

Calculate: $P[A \cup B]$, $P[A^c]$, $P[B^c]$, $P[A \cap B^c]$, and $P[(A \cap B)^c]$.

05

✍ **Inclusion-exclusion reasoning**

Your friend says: “according to my calculations, the probability of A is 0.5 and the probability of B is 0.7, but the probability of A and B both happening is only 0.001.”

You tell your friend they don’t understand probability. Why?

06

✍ **Inclusion-exclusion reasoning**

Suppose $P(A) = 0.4$ and $P(B) = 0.7$. Show that $0.1 \leq P(AB) \leq 0.4$.

07

✍ **Probability - flip a coin three times**

A coin is flipped three times.

What is the probability that at least two heads appear?