Statistical Dependency

And Examples with Dependent Events

Prof Hans Georg Schaathun

Høgskolen i Ålesund

1st April 2014

The Coin Toss

1. We shall toss two coins
2. One coin is fair
   - 50-50 chance of head and tail
3. One coin is bent
   - 75% probability of head
4. You do not know which coin is which.

The first coin toss

1. Draw one coin at random.
2. Toss the coin
3. What is the probability of head?

The probability of two heads

- Two head means $H_1 \cap H_2$
  - $P(H_1 \cap H_2) = ?$
- Hard way:
  - $P(H_2|H_1) \cdot P(H_1)$
  - Each H_i depends on the Bent-event.
- Easier approach.
  - We throw a bent coin and a fair coin
  - It does not matter which one is thrown first.
  - $P(H_B) = 0.75$, $P(H_F) = 0.5$
  - H_B and H_F are independent events
  - $P(H_1 \cap H_2) = P(H_B \cap H_F) = 0.75 \cdot 0.5 = 0.375$

The second coin toss

- Symmetric problem
  - $P(H_2) = P(H_1)$
- What if we know whether H_1 occurred?
  - What is $P(H_2|H_1)$?

Summary

- Conditional Probability
  - $P(A|B)$ - the probability of A, assuming that B occurred
- Independent events if $P(A|B) = P(A|\neg B)$
- Dependent events if $P(A|B) \neq P(A|\neg B)$
- The joint probability $P(A \cap B)$
  1. $A \cap B$ means both A and B occur
  2. $P(A \cap B) = P(A|B) \cdot P(B) = P(B|A) \cdot P(A)$

HØGSKOLEN I ÅLESUND
Aalesund University College