

Tree Diagrams and Markov Processes

Section 6.5 and 8.1

April 12, 2016

Tree Diagrams

A box contains five good light bulbs and two defective ones. Bulbs are selected one at a time (without replacement) until a good bulb is found. Find the probability that the number of bulbs removed is...

- two
- three

Example

There is a box with 4 green balls and 3 orange balls. One ball is drawn at a time (without replacement) and its color is observed. The experiment ends when a green ball is drawn.

- 1 Draw a tree diagram representing this experiment.
- 2 What is the probability that we stop after drawing exactly two balls?

Example

A card is drawn from a 52-card deck. If the card is a picture card, we toss a coin. If the card is not a picture card, we roll a dice.

- 1 Find the probability that we end the sequence with a '6'.
- 2 Find the probability that we end the sequence with a 'head'.

Definitions

Definition

If the probabilities of the various outcomes of the current experiment depend (at most) on the outcome of the preceding experiment, we call such a sequence of experiments a **Markov process**.

Example: Investment

- A particular utility stock is very stable, and in the short run, the probability that it increases or decreases in price depends only on the result of the preceding day's trading.
- The price of the stock is observed at 4 pm each day and is recorded as 'increased', 'decreased', or 'unchanged'.
- The sequence of observations forms a **Markov Process** because the current outcome (the price of stock) depends at most on the preceding outcome (price from yesterday).

Example: Sociology

- A sociologist postulates that the likelihood that in certain countries a woman will enter the labor force depends primarily on whether her mother worked.
- She designs an experiment to test this hypothesis by viewing the sequence of career choices of a woman, her daughters, her grand-daughters, her great-grand-daughters and so on.