Introduction to Probabilistic Graphical Models
Homework 2

Umut Şimşekli
Télécom ParisTech, Université Paris-Saclay, Paris, France
umut.simsekli@telecom-paristech.fr

Instructions: Put all your files (code and report) in a zip file: *surname_name_hw1.zip* and submit it through moodle before October 19 2016, 13:59. Late submissions will not be accepted.

Question 1

Suppose that we have three colored boxes r (red), b (blue), and g (green). Box r contains 3 apples, 4 oranges, and 3 limes, box b contains 1 apple, 1 orange, and 0 limes, and box g contains 3 apples, 3 oranges, and 4 limes.

Now, recall the Question 3 of the previous homework. Choose the appropriate random variables and draw a directed graphical model for this problem.

Question 2

We want to model a domain where we want to model a troubleshooter for a printer. A printer can print successfully a page or not. There are possible reasons for failure. The driver is corrupt, the printer is not plugged to the computer, the printer may be out of paper, if the printer is a network printer, there might be a problem with the network software. Another possibility is that there is no power. If there is no power the lights in the room are also off.

1. Carefully define the appropriate random variables to represent this scenario.
2. Draw the directed graphical model.

Question 3

A die is selected at random from two twenty-faced dice on which the symbols 110 are written with nonuniform frequency as follows.

Symbol	1	2	3	4	5	6	7	8	9	10
Number of faces of die A	6	4	3	2	1	1	1	1	1	0
Number of faces of die B	3	3	2	2	2	2	2	2	1	1

1. The randomly chosen die is rolled 7 times, with the following outcomes:

   $$5, 3, 9, 3, 8, 4, 7.$$

   What is the probability that the die is die A?

2. Assume that there is a third twenty-faced die, die C, on which the symbols 120 are written once each. As above, one of the three dice is selected at random and rolled 7 times, giving the outcomes:

   $$3, 5, 4, 8, 3, 9, 7.$$

   What is the probability that the die is die A, die B or die C?

3. Choose the appropriate random variables and draw directed graphical models for both problems.