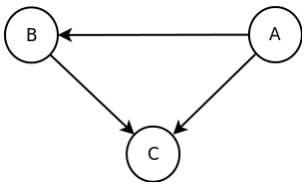
# Bayesian Networks - Exercise Sheet 5

Solutions need to be handed in until **Monday, November 28th 12pm**

## Exercise 1: Bayesian Networks (10 Points)

In Figure 1 the DAG $G$ is sketched that represents a graphical model.




$A, B$ and $C$ are representatives for the following binary events.

- $A$: It is raining.
- $B$: The sprinkler is activated.
- $C$: The grass is wet.

The joint probability distribution $P_1$ is given:

| $A$ | $B$ | $C$ | $P_1(A, B, C)$ |
|---|---|---|---|
| 0 | 0 | 0 | 0.48 |
| 0 | 0 | 1 | 0.00 |
| 0 | 1 | 0 | 0.032 |
| 0 | 1 | 1 | 0.288 |
| 1 | 0 | 0 | 0.0396 |
| 1 | 0 | 1 | 0.1584 |
| 1 | 1 | 0 | 0.00005 |
| 1 | 1 | 1 | 0.00198 |

a) Estimate the factorization of $P_1$ through $G$.

b) Estimate the for the factorization required marginal and conditional distributions and verify the factorization.

c) Evaluate the sense of meaning of this factorization. The the evaluation based on the graph $G$ and then once again by comparing the sum of parameters of $P_1$ and its factorization.

### Exercise 2: Conditional Independencies in R / Minimal DAG Representation

a) For this task you might want to read chapter 1, 2 and the appendix of `http://cran.r-project.org/doc/manuals/R-intro.pdf`.

b) Load the probability distribution $P_2$ from **jpd.csv** and investigate it for conditional independencies. Note down all independencies of $P_2$.

c) Estimate all minimal representations of $P_2$ using Lemma 9. Sketch the resulting Graph. Is there anything noticeable?