

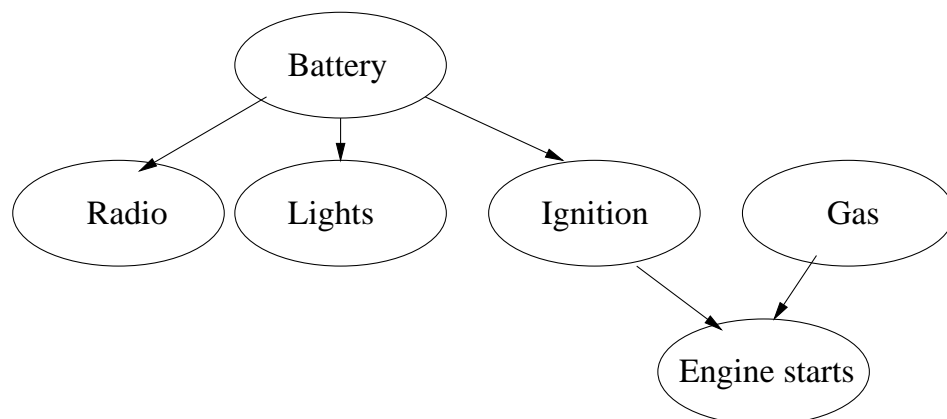
Problem assignment 10

Due: November 12, 2020

Machine Learning

Problem 1. Learning parameters of the Bayesian belief network

Assume the Bayesian belief network for the diagnosis of the engine problem in the figure below.



All variables in the network are binary with true, false values.

Assume we have collected the data from different car repair shops in the neighborhood and we want to learn the parameters of the network. The data are given as vectors of values for every variable in the network. The data for variables are given in the following order: (Battery, Radio, Lights, Ignition, Gas, EngineStarts).

The values are encoded using binary values: 1 for True and 0 for False. Your dataset is as follows:

```

1 1 1 1 1 1
1 1 1 0 1 0
1 0 1 1 1 1
1 0 1 1 1 0
0 1 0 0 1 0
1 1 1 0 0 0
1 1 1 1 1 1
1 1 0 1 1 1
1 1 0 1 1 1
1 1 0 1 0 1
1 0 0 1 1 1
0 0 0 1 1 1
1 1 1 0 1 0
1 1 1 1 0 0
1 0 1 1 0 1
1 0 1 0 1 0
1 1 1 1 1 1
1 0 1 1 1 0
1 1 0 1 0 1
0 0 1 0 0 0

```

Compute the ML estimates of the following probability parameters of the BBN network:

- $P(Gas)$
- $P(Lights|Battery = T)$
- $P(Lights|Battery = F)$
- $P(Ignition|Battery = T)$
- $P(EngineStarts|Ignition = T, Gas = T)$
- $P(EngineStarts|Ignition = T, Gas = F)$