

Homework 4: Approximate Inference in Bayesian Networks

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1 Sampling Methods

In this assignment, I implemented Rejection Sampling and Gibbs Sampling to generate samples for a Bayesian network.

For Rejection Sampling, the implementation is quite simple. Samples are generated ignoring the constraints of the evidence. Then, samples inconsistent with the evidence are dropped. In the remaining samples, proportion of samples consistent with the query is returned.

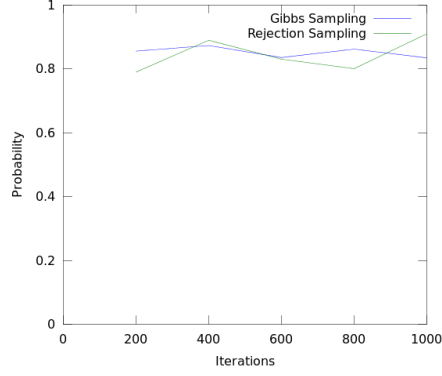
For Gibbs Sampling, in each iteration, for node x_i , it is sampled from the following probability (revised from the textbook).

$$p(x_i | x_{\{j \neq i\}}) \propto \prod_k P(x_k | pa_k) \quad (1)$$

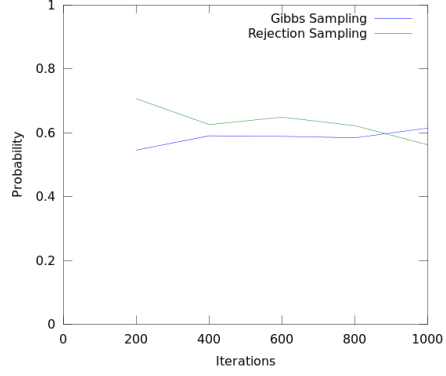
2 Experiments

In this experiment, I used the data provided by Ian. The results generated are shown below.

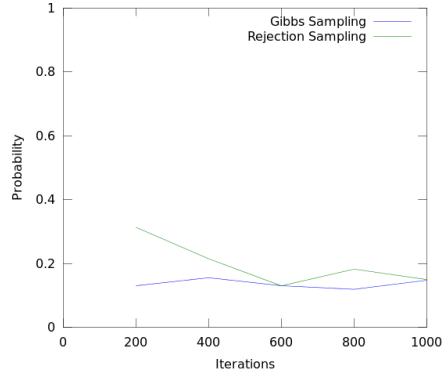
In Figure 1, I show the learning process in each sampling algorithms, for each query data for the first evidence given.



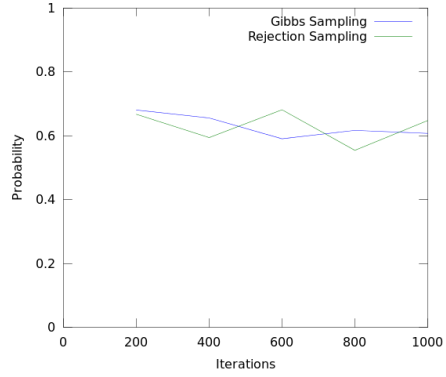
(a) $P(X_0 = 1|E_1)$



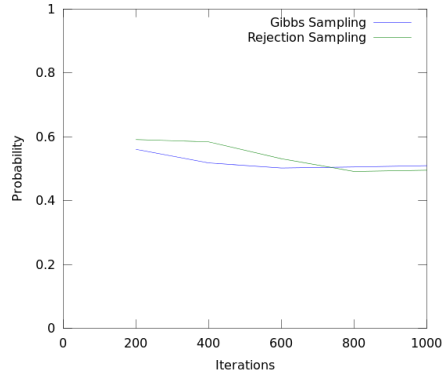
(b) $P(X_1 = 1|E_1)$



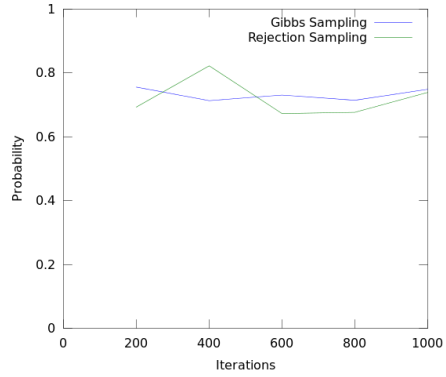
(c) $P(X_2 = 1|E_1)$



(d) $P(X_3 = 1|E_1)$



(e) $P(X_4 = 1|E_1)$



(f) $P(X_5 = 1|E_1)$

Figure 1: Sampling process for each test case. E_1 denotes $(X_6 = 1, X_7 = 0, X_8 = 0)$.