Belief networks are commonly used for reasoning in the presence of uncertainty. For this assignment you will choose a situation described by one of the data sets available at:

http://www.ics.uci.edu/~mlearn/MLRepository.html

Note the data set you use should contain no missing values and you should use only the nominal attributes. Please present all code as email attachments.

Question 1). Which Network Structure Is Best? (50 points)

a) Create two reasonable alternative network/graph structure and write code to learn the parameters of the belief network.

b) Present the graph structure and learnt network parameters for both situations

c) Present your psuedo code for the learning algorithms

d) Using the Bayesian information criterion (BIC) choose the most probable.

Question 2). Approximate inference using Gibbs samplers (50 points)

Exact inference in belief networks is NP-hard so we must use approximation algorithms such as the Gibbs sampler.

a) Present one reasonable diagnostic query and one predictive query.

b) Implement either the prior, rejection or likelihood weighting samplers. Present your psuedo code

c) Do use a sampler you must ensure that it is sampling from the stationary distribution. Specify a method to ensure this that you will later use.

c) Use your sampler to find approximate answers to the queries specified in section a).