Lab 2: Bayesian Networks

For this lab, you will need to download the Genie software package from the University of Pittsburgh, which can be found at this website:

http://genie.sis.pitt.edu/

Create a Bayesian network in which there is a Disease node with multiple states and a set of symptoms that are conditionally independent of each other given the state of the disease variable. The disease variable (called D) has the following prior probabilities over its 3 mutually exclusive and exhaustive states.

- P(Disease= none) = 0.9
- P(Disease=influenza)=0.08
- P(Disease=ebola)=0.02

Knowledge of each symptom is as follows:

1. Fever (States: false, true)
    - P(Fever=false|Disease=none)=0.99
    - P(Fever=false|Disease=influenza)=0.02
    - P(Fever=false|Disease=ebola)=0.01
    - P(Fever=true|Disease=none)=0.01
    - P(Fever=true|Disease=influenza)=0.98
    - P(Fever=true|Disease=ebola)=0.99
2. Cough (States: false, true)
    - P(Cough=false|Disease=none)=0.99
    - P(Cough=false|Disease=influenza)=0.05
    - P(Cough=false|Disease=ebola)=0.9
    - P(Cough=true|Disease=none)=0.01
    - P(Cough=true|Disease=influenza)=0.95
    - P(Cough=true|Disease=ebola)=0.1
3. Diarrhea (States: false, true)
    - P(Diarrhea=false|Disease=none)=0.95
    - P(Diarrhea=false|Disease=influenza)=0.8
    - P(Diarrhea=false|Disease=ebola)=0.02
    - P(Diarrhea=true|Disease=none)=0.05
    - P(Diarrhea=true|Disease=influenza)=0.2
    - P(Diarrhea=true|Disease=ebola)=0.98

Your tasks are as follows:

1. Create a Bayesian network in Genie representing the joint probability distribution above.
2. How many entries in the full joint probability distribution table were saved by making the assumption that the symptoms are conditionally independent given the disease?
3. Calculate P(Disease=Influenza|Fever=true,Cough=true,Diarrhea=true) using Genie's inference engine.
4. Calculate P(Disease=Influenza|Fever=true,Cough=true,Diarrhea=true) manually, using the joint probability distribution represented by the Bayes net. Does your answer match Genie's?
5. Calculate P(Fever=true|Cough=true,Diarrhea=true) using Genie's inference engine.
6. Calculate P(Fever=true|Cough=true,Diarrhea=true) manually, using the joint probability distribution represented by the Bayes net. Does your answer match Genie's?