**Artificial Intelligence – Assignment #3**

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For this Assignment I have chosen Lung Cancer as a model for my Bayesian Network. I have chosen this model because there are many symptoms and related illnesses that can contribute to Lung Cancer. So it is essential that while diagnosing lung cancer, people involved must be confident about the existence of the disease as they symptoms don’t always present a clear picture.

The basic model was constructed through my research on lung cancer online. I studied similar diseases to lung cancer though their common symptoms, and the actions that cause them. The basic idea of my model can be broken down to 3 types of nodes: Disease, Symptom and Hazard. Diseases are resulted from hazards which can be described as actions, while Diseases cause Symptoms. That is the reason why the disease nodes have hazard nodes coming into them. Similarly, the symptoms have arrows from disease nodes pointing into them.

To start my Model, I modeled the hazards to diseases first. A weak defense system makes the body vulnerable to pneumonia (a disease which share a lot of common symptoms with lung cancer and is likely to be wrongly believed to be lung cancer). Pneumonia is linked with its most common symptoms. Lung Cancer’s biggest hazard on the other hand is Smoking and, so it is connected to that. The hazards don’t have any inward arrows as it is very difficult to assume the causes for them. Common cold and Bronchitis are two other diseases that share many symptoms with Lung Cancer and Pneumonia, so it makes sense to consider a possibility for them as well. Shortness of breath is the most common symptoms in my model with three diseases causing it. There are stand-alone symptoms as well which are only caused by one type of diseases considered in my model. Rhinorrhea is only caused by Common Cold and this is a strong evidence for the existence of Common Cold. Common Cold does not have any hazard as there is not any strong evidence to suggest what exactly causes it and it did not fit my model well.

The probabilities were also calculated mostly through online research, while for some I used intuition to the best of my knowledge. For some conditional probabilities I used the intuition that while it may be possible that a symptom is caused by 2 different diseases however, even in the absence of the second disease, the probability of that symptom should be much the same.

**Inferences**

1. If we consider fever to be present and rhinorrhea to be absent, then the chances of Pneumonia are increased drastically (Highest of all diseases - 45%) compared to the default settings.
2. The chances of Lung Cancer being present in a patient is higher if the symptoms of chest pain and shortness of breath are present, and the symptoms of fever and coughing are absent. So we can rule out other diseases due to lower probabilities. The probability for lung cancer becomes slight more than 0.5.
3. We can rule out severe diseases such as Lung Cancer, Pneumonia and Bronchitis if we know the patients habits. If he/she is not a smoker or does not get sick often, accompanied with any of the two symptoms of common cold, we can with good confidence (high probability) infer that the culprit is common cold.
4. Similar to the previous case, if the patient is sick, with a symptom such as coughing or chest pain. Then the situation becomes very different as Pneumonia is also likely to be the culprit, in addition to common cold, due to sharp rise in probability of Pneumonia (0.9). We can infer that the patient is likely to have a weak defense system and so anti-biotics can be prescribed as well.
5. We can also infer to rule out all the diseases that are considered in my model. If a patient is not sick often and is not a smoker but still suffer from chest pains and coughs, then the culprit is not likely to be among the four mentioned diseases in my model (all have probabilities less than 0.1) and so, a different diagnosis can take place, saving crucial time for the patient.