Temogen

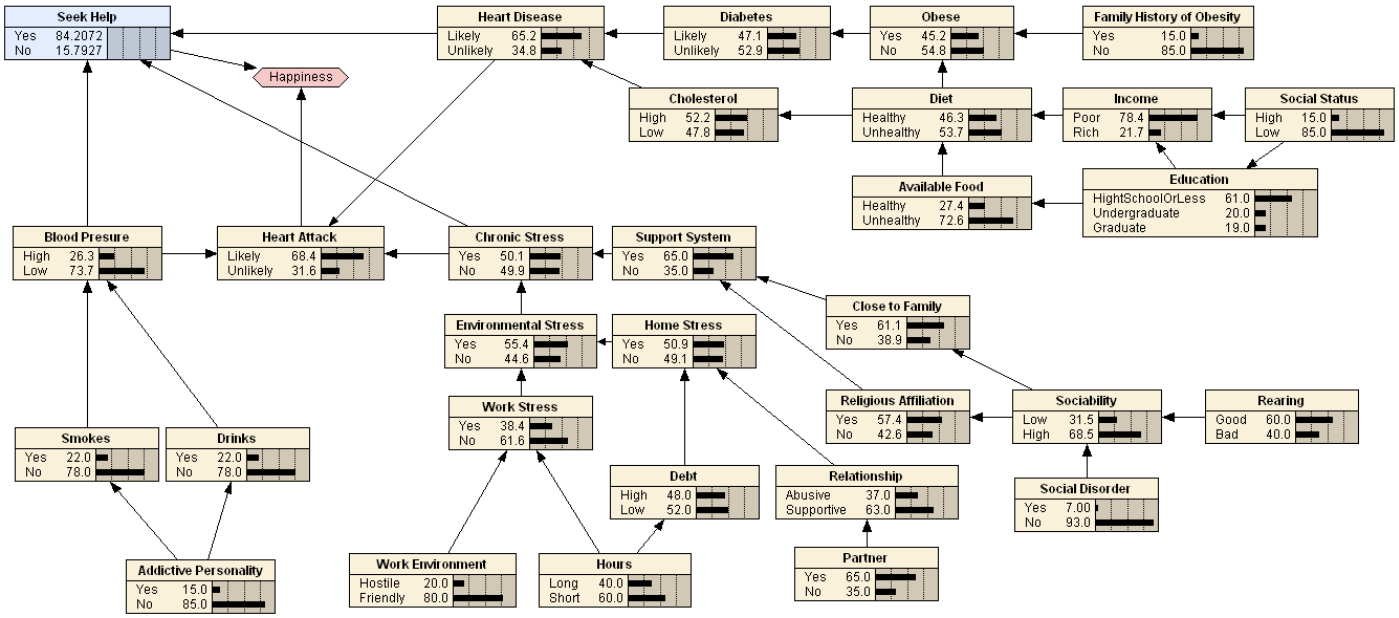
CS 514 Project 4 – Bayesian Network and Decision Nodes

Running:

In order to run this project, you will be required to have an activated version of the Netica software by Norsis. If you're running this on a PC, simply selecting the file from your folder will open Netica, and the specified file. On a Mac, you will be required to install, or run (if already installed) CrossOver for Mac. Once there, open the Netica "bottle". From Netica, you are able to open the specified file from the directory in which you saved the project folder. Once you open the file, you will be able to see the full Bayesian network, and interact with it.

Introduction:

For this project, I've modified the previous Bayesian Network that looked at the probability of a person getting a heart attack. The previous project looked at the relation of the person's habits, genetics, and environment and the chances of them having a heart attack. The modifications for this project were for clarities sake, as well as the addition of the decision node. The following image will show you the current state of the Bayesian network.



In the previous version, there were only two main branches leading to the 'Heart Attack'. In this version, I separated the 'Chronic Stress' branch from the 'Heart Disease' node, and connected it directly to the 'Heart Attack' node. This was mainly because, after some deliberation, it was apparent that the large branch was reducing the impact of the social as well as the genetic factors on the 'Heart Attack.' At its current incarnation, there is a clearer path from the various factors, to the final state. These changes allowed me to make a more concise, and understandable decision network.

The psychological factors would also be able to include the diet, since it is a personal choice, but it was more tightly related to the environmental and genetic states. These were also more related to

the social status of the person. In reality, it appears that environment would have the largest impact in the overall outcome of the decision node. This would lead to a lot of interwoven, and complicated networks. For this prototype, clarity was more important than precision. Hence, the network has far fewer nodes, and connections than it will have in the final product.

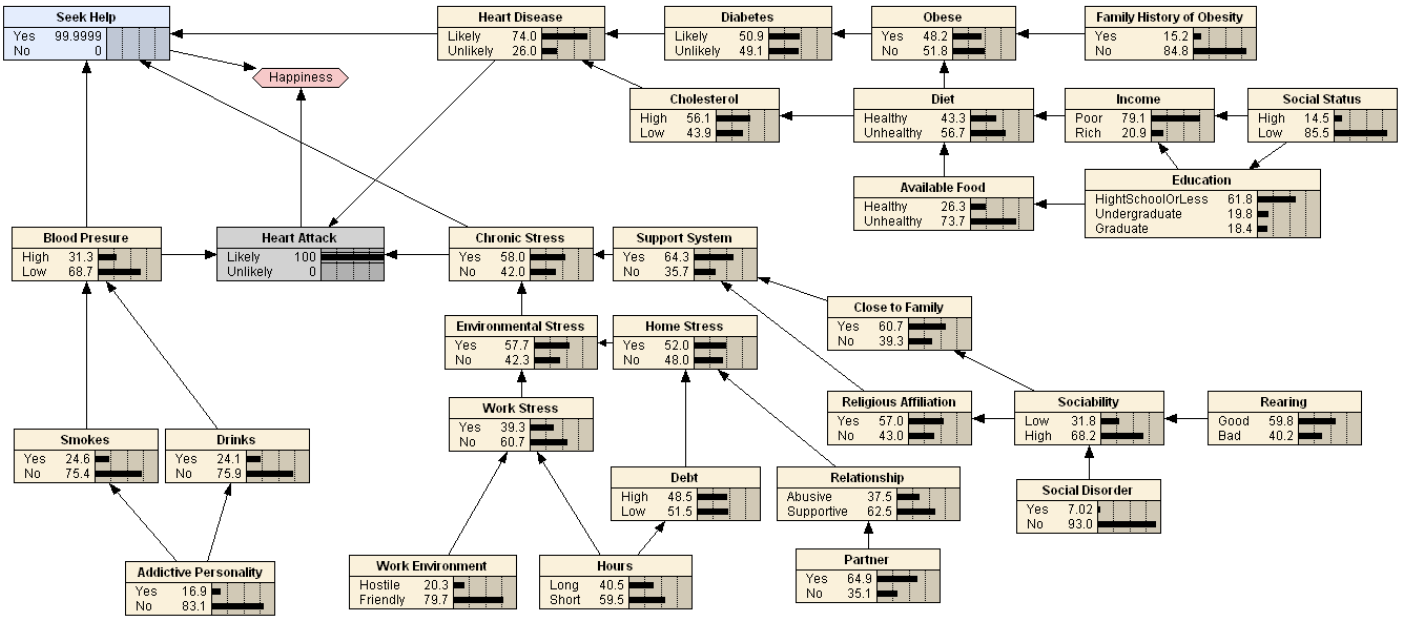
Finally, for this introduction, the lowest node of these three branches was connected to the decision node. And the 'Heart Attack' node was attached to the utility node. The reason for this is, since the project aims to prevent people from suffering heart attacks, we would ideally like to reduce the chances of having a heart attack. So, when the nodes closer to the heart attack are increasing in probability, the person should be encouraged to seek help. Of course, since the 'Heart Attack ' node is connected to the utility node, when the certainty of a heart attack is 100% you will definitely want to seek help; hence the limit is towards 100%. This and other states will be discussed in the testing section, which will focus primarily on the addition of the Utility and Decision nodes.

Testing:

The following test cases are available in the project folder. You may be required to open the main '.neta' file in order to run these test cases. Once there, you can duplicate these test cases, or create some of your own!

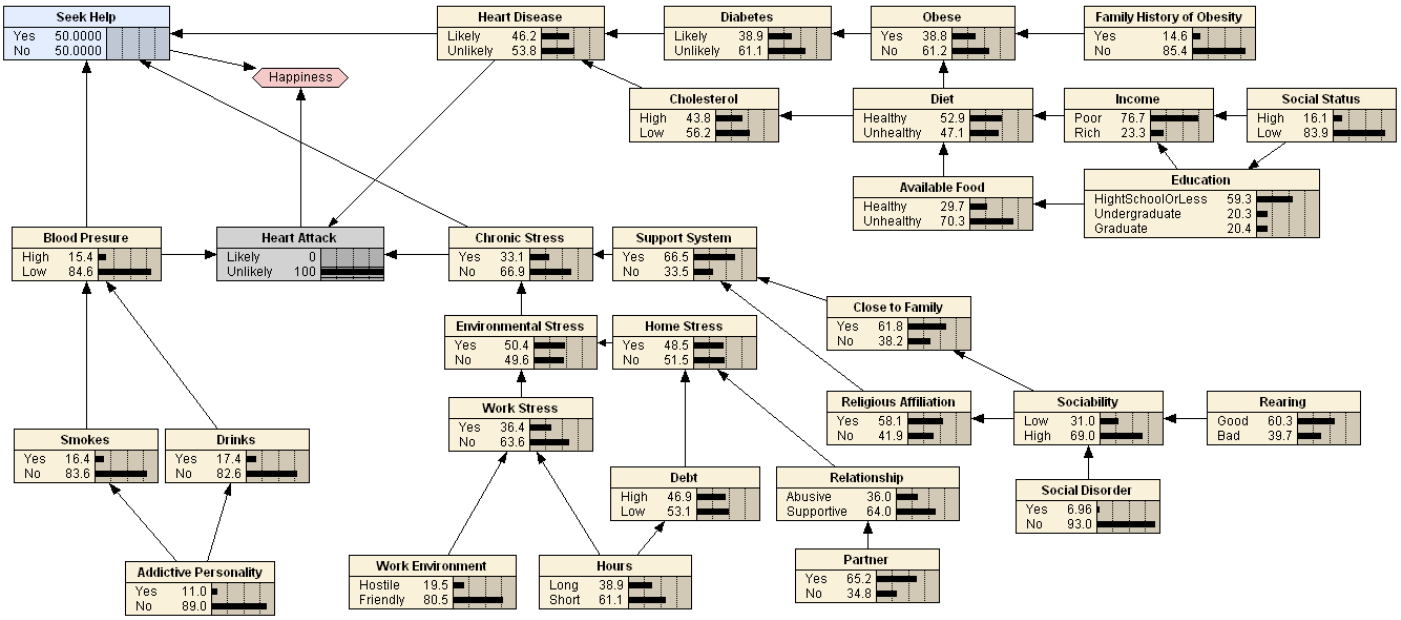
For test case one, the network shows that, when a heart attack is certain, you will most definitely like to seek help; here it has a probability of 99.9999, trending towards 100%. This is, for obvious reasons, a logical conclusion. This doesn't go up to 100, since it is dealing with probabilities. There can be a case, where experiencing the heart attack could be beneficial to the persons family, in their eyes. It may not appear reasonable, but if their insurance would help their family, it may be considered a reasonable decision. Though, that is a very rare and unlikely case, hence the infinitely small number.

Case 1:



The second test case covers the opposite of case one. In this case we will see what the decision would be if a heart attack is unlikely. As you can see, even when a heart attack is unlikely, it cannot definitively say whether or not you should be getting help. There may be some instances where you may benefit from seeing help, but never getting help for something is not an option. The rational behind this decision is, though you are 100% unlikely to have a heart attack, there are other issues that can occur from high blood pressure, heart disease, or chronic stress. Hence, the patient, or consumer would never be encouraged to not seek help. This will also prevent any liability, on our company, or any company utilizing this application, from a person not receiving assistance and experiencing a heart attack.

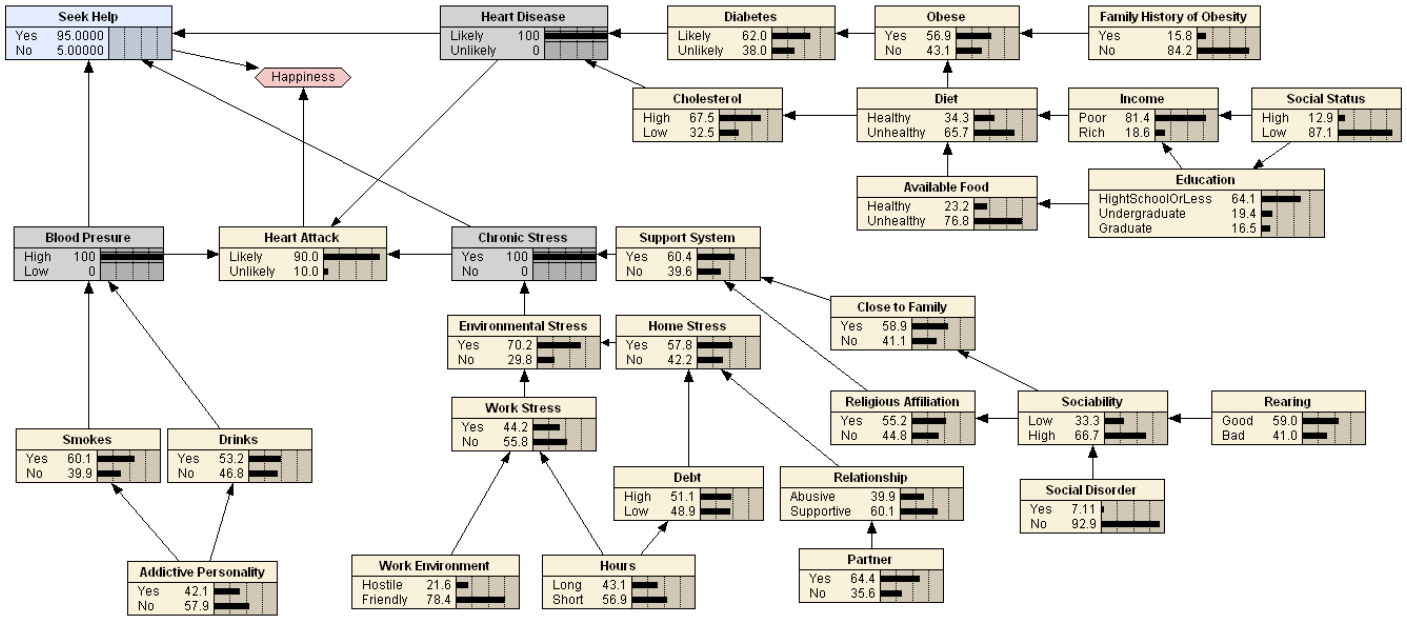
Case 2:



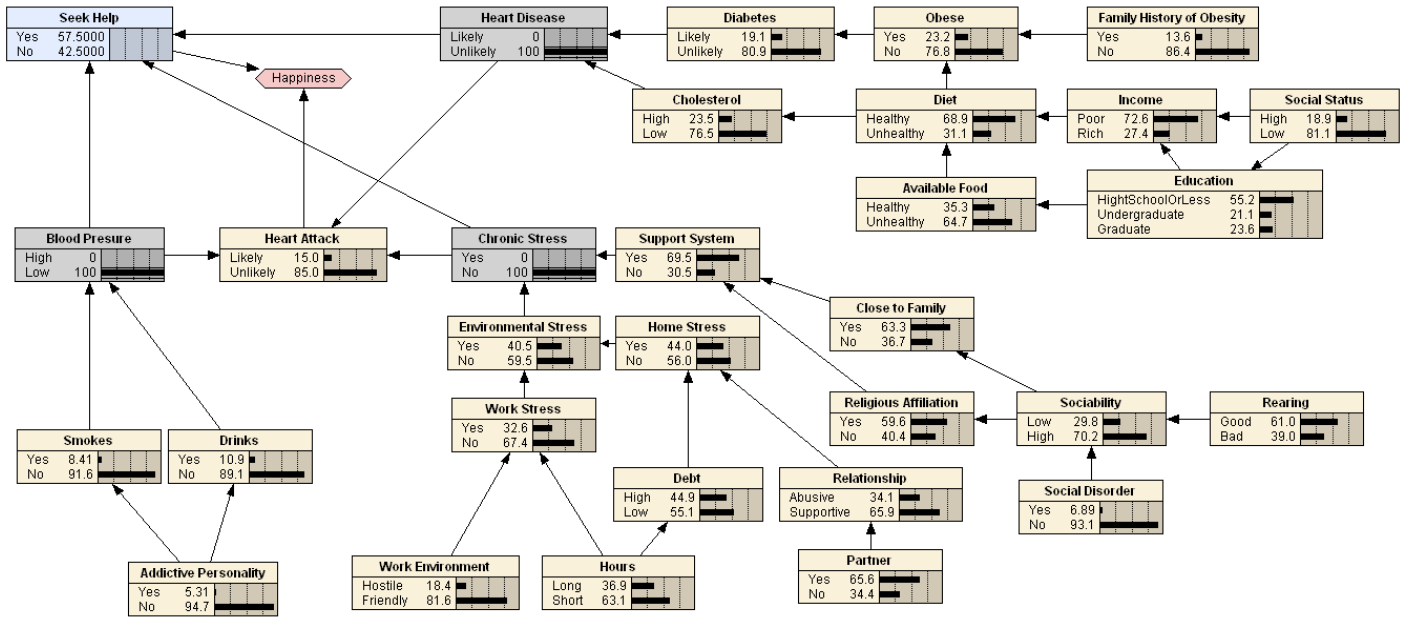
Cases three and four are shown below. They are, as case one and two were, opposing probabilities. In case three we see the outcome of the decision when heart disease, chronic stress, and blood pressure are issues in the patient. They have a high probability, 95%, of likelihood that they should seek help. Unlike the certainty that there is 100% chance of having a heart attack, this doesn't have as close a limit, trending towards 100% for seeking help. The reasoning behind this is, that additional factors may come into play. Say, the person doesn't have a means to getting to the hospital, or they do not want to burden others. There are also cases where the cost of getting checked up is not worth the uncertainty of actually having a heart attack; these could be because of hospital costs, perceived costs of other expenses, relative to the benefits of potentially having a heart attack.

Case four shows the opposite, and similar to a person being unlikely to have a heart attack. They would not be given a completely split decision, since the likely hood of having a heart attack is non-zero. Hence, the likelihood that they should seek help is also greater than 50%. To that extent, it is a fairly reasonable conclusion. You would like them to have some more insight into what those causes could be, but they are not required to go out of their way for testing. In general, they are in a good place.

Case 3:

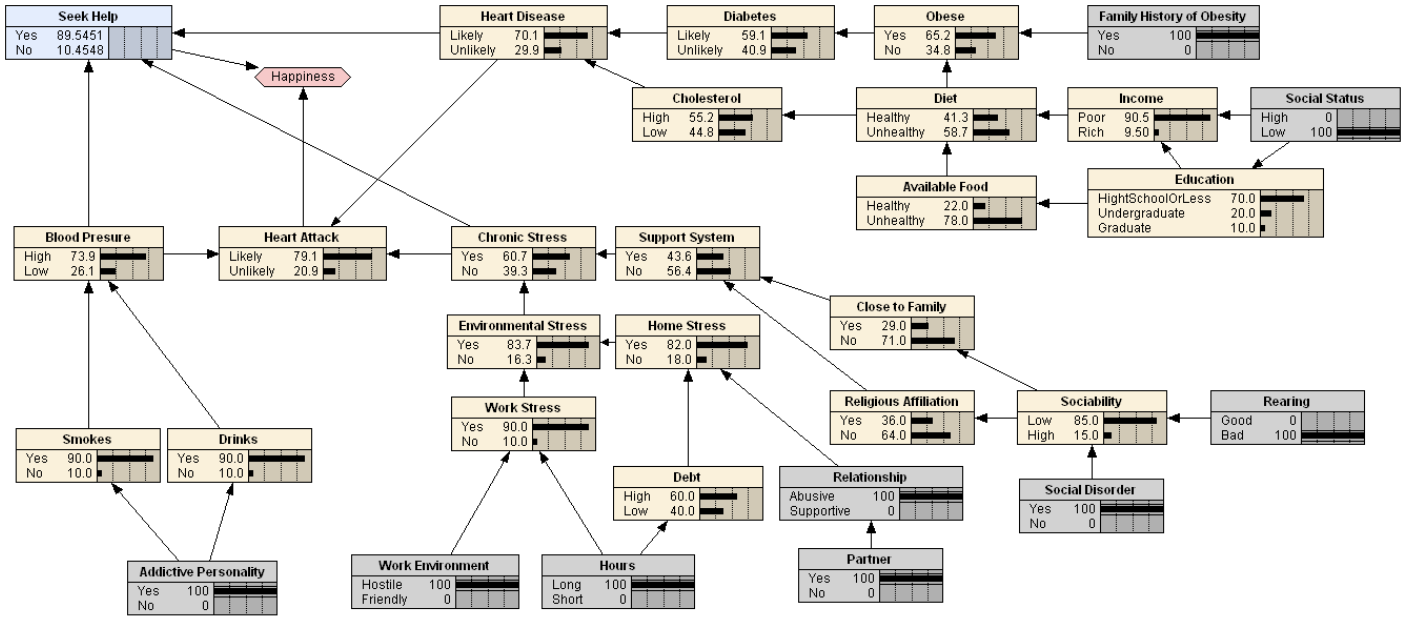


Case 4:

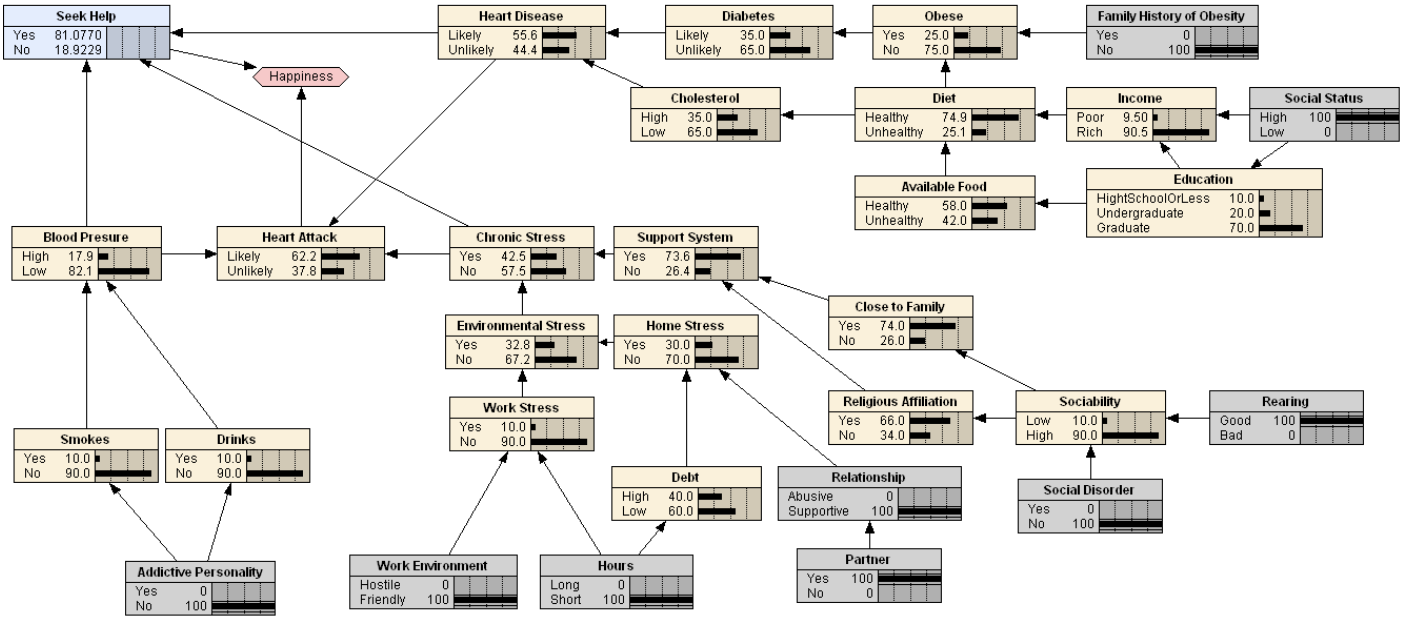


The next two cases are five and six. These cases are similar to the second case presented in the previous Bayesian network. It shows how little effect the further nodes have on the decision node. Though the overall impact is noticeable, the decision has not been changed by a great degree. The person would still be greatly encouraged to seek help. You'll notice that the 'Relationship' and 'Partner' nodes have both been assigned a value—this is no accident. Having a partner is not negative or positive in itself, but may lead to a great deal of negative or positive influence in the persons well being; depending on their level of support.

Case 5:



Case 6:



Case seven and eight will be included in the project folder, but will be excluded from the report since it is more redundant than beneficial. If you look at these cases, you'll see that the impact is greater than cases five and six. Furthermore, you will notice that, since the first branching nodes ('Blood Pressure', 'Chronic Stress', and 'Heart Disease') are not all activated, the decision node is not impacted to the greatest degree, as seen in cases three and four.

Discussion:

With regard to the current network, you will note that the individuals using this network will have greater clarity than the initial project. They will be given a number, related to the probability that the person should seek help. Further development into this project would lead to more concise and clear definitions as to what an individual should do; perhaps even setting plain language terms to prevent ambiguity for the person. This can also be used for health insurance companies, with some modifications to the decision node. Mainly, should this person be insured, and what should their premium be. Though, the intent would ideally be for preventing someone's demise, the applications and necessity for funding is real.

The test cases discussed were extreme examples, and hence wide ranges of examples were not covered. There are many different potential variations of impact. I encourage you to play with the network, but don't take the outcome seriously. It is a prototype, and the values used for the probabilities were not thoroughly researched.