1 Problem 1: Constraint Propagation: Diagnosis (20 points)

In medical diagnosis, the goal is to determine, based on the observed symptoms, from which disease the patient suffers. Thus the relationship between diseases and symptoms may be modeled as a bipartite graph with "may-cause" arcs from diseases to symptoms. By Occam's razor, the simplest explanation that covers the data is best; for diagnosis, this corresponds to the smallest number of diseases that account for the symptoms.

We can formulate the diagnosis problem as a constraint satisfaction problem. We restrict the bipartite graph to only those symptoms that are actually present and remove all diseases that do not have at least one "may-cause" arc incident on an observed symptom. We assume two sets of variables: symptom variables and disease variables, where the number of disease variables is the maximum number of diseases that we will allow in our diagnosis. Each disease variable can take on one of the diagnosable diseases or 'Absent' indicating that the disease is absent.

1.1 Part A: Domains (4 points)

What values can the symptom variables take on?

1.2 Part B: Symptom Constraints (4 points)

What constraints hold between the symptom variables?

1.3 Part C: Disease Constraints (4 points)

What constraints hold between disease variables?

1.4 Part D: Symptom-Disease Constraints (4 points)

What constraints hold between symptom and disease variables?