Answer all four questions below. Due date is MARCH 4th.

1. (25 points) Consider the following sentences:
   • John likes all kinds of food
   • Apples are food
   • Chicken is food
   • Anything anyone eats and isn’t killed by is food
   • Bill eats peanuts and is still alive
   • Sue eats everything Bill eats

   a. Translate these sentences into formulas in first order logic
   b. Convert the formulas of Part a. into clause form
   c. Use resolution to prove that John likes peanuts
   d. Use resolution to answer the question, "What food does Sue eat?"

2. (25 points) Consider the following facts:
   • The members of the Elm St. Bridge Club are Joe, Sally, Bill, and Ellen
   • Joe is married to Sally
   • Bill is Ellen’s brother
   • The spouse of every married person in the club is also in the club
   • The last meeting of the club was at Joe’s house

   a. Represent the facts in first-order logic
   b. From the facts given above, most people would be able to decide on the truth of the following additional statement:
      • The last meeting of the club was at Sally’s house

      can you construct a resolution proof to demonstrate the truth of this statement given the five facts listed above? Do so, if possible. Otherwise, add the facts you need and then construct the proof.

3. (25 points) What is wrong with the following argument?
   • Men are widely distributed over the earth
   • Socrates is a man
   • Therefore, Socrates is widely distributed over the earth

   How should the facts be represented by these sentences be represented in logic so that this problem does not arise?
4. (25 points) Suppose you are given the following facts:

\[
\begin{align*}
\forall x, y, z &. gt(x, y) \land gt(y, z) \Rightarrow gt(x, z) \\
\forall a, b &. succ(a, b) \Rightarrow gt(a, b) \\
\forall x &. \neg gt(x, x)
\end{align*}
\]

and you want to prove that gt(5,2) is true. Consider the following attempt at a resolution proof:

\[
\begin{align*}
\neg gt(5,2) & \quad \neg gt(x, y) \lor \neg gt(y, z) \lor gt(x, z) \\
\neg gt(5, y) \lor \neg gt(y, 2) & \quad \neg succ(a, b) \lor gt(a, b) \\
\neg gt(5, y) \lor \neg succ(y, 2) & \quad \neg gt(x, y) \lor \neg gt(y, z) \lor gt(x, z)
\end{align*}
\]

\[
\begin{align*}
\{5/x, 2/z\} & \\
\{y/a, 2/b\} & \\
\{5/x, y/z\}
\end{align*}
\]

a. What went wrong?

b. What needs to be added to the resolution procedure to make sure that this does not happen?