Q1) Design a classification system (in prolog language) to classify English sentences according to the context free grammar that is used in natural language processing with non terminal terms only by using backward chaining. (10 degrees)

Q2) Suppose the following natural human genetic information in each chromosome:
   1. Male or female represents the first gen 1 or 0 respectively.
   2. Short or tall represents the second gen 1 or 0 respectively.
   3. Nervous or calm represents the third gen 1 or 0 respectively.
   4. (X) blood type or not represents the fourth gen 1 or 0 respectively.
   5. Intelligent or not represents the fifth gen 1 or 0 respectively.

By using the genetic operations can you obtain the 10101 chromosome depending on the following initial population? (Let crossover point K = 2 from left and the mutation point in 14th position) (10 degrees)

10010  00111  00100  11111

Q3) Consider the following production rules:

If C2 and C3 then C1
If e1 then C2
If e2 or not(e3) then C3
If e4 then C3

e1= -0.8  e2= 0.2  e3= 0.4  e4= 0.6 and the value of all implications (imp) is equal to 0.5.

1- Find the certainty factor for the node C1. (6 degrees)
2- Show the contents of WHY stack when the system asks the user about the certainty value of node e1 and the user ask why. (2 degrees)
3- Describe the HOW explanation when the user asks H C3. What is the system response? (2 degrees)

Q4: A) Compare between the following: (choose only one). (5 degrees)

1. Hebbian and delta rules in the NN training.
2. Genetic algorithm and genetic programming.
B) Write a complete computer program (through MATLAB environment) to execute one of the following ANN: (5 degrees)
   1. The Hopfield neural network.
   2. The Adaline neural network.
   3. The Kohonen neural network.

Q5) by using prolog language write the following rules (choose only five rules to solve): (10 degrees 2 degrees for each rule)

getttype, qualifier, supercombine, and how describe in the complete fuzzynet program with explanation mechanism, and append, agent, and docdriver in the complete natural language processing program.

Q6) A BAM Neural Network is trained using the following input and output patterns:

\[
A_1 = (1 \ 0 \ 0) \quad B_1 = (0 \ 0 \ 1) \\
A_2 = (0 \ 1 \ 0) \quad B_2 = (0 \ 1 \ 0) \\
A_3 = (0 \ 0 \ 1) \quad B_3 = (1 \ 0 \ 0)
\]

In one iteration only apply an input vector \( A_3 = (0 \ 0 \ 1) \) to test the net behavior and performance for remembering. (10 degrees)

Good Luck