Assignment 2

   Classification of Irsi data is a well known benchmark problem in machine learning research. This data set is downloadable from .The problem in Iris data is to classify three species of iris (setosa, versicolor and virginica) by four-dimensional attribute vectors consisting of sepal length (x_1), sepal width (x_2), petal length (x_3) and petal width (x_4). There are 50 samples of each class in this data set.

   We now consider a *fuzzy classifier* with a set of fuzzy rules to classify Iris data. The values of attributes are normalized before fuzzy processing according to

$$x'_i = \frac{x_i - \min(i)}{\max(i) - \min(i)}$$

where max(i) and min(i) denote the maximum and minimum values of attribute x_i respectively. Every attribute of the fuzzy classifier is assigned with three linguistic terms (fuzzy sets): *short, medium* and *long*. With normalized attribute values, the membership functions of these fuzzy sets for all the four attributes are depicted in the figure below (assume the membership functions for different attributes are identical).
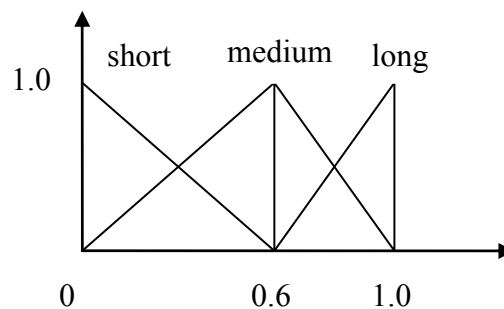

Fig. The membership functions of the attributes for Iris problem

   Further we suppose that the following set of fuzzy rules have been defined by experts to classify iris data. The membership functions used by these rules are those depicted in the figure above.

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r₁: If (x_1=short ∨ long) and (x_2=medium ∨ long) and (x_3=medium ∨ long) and (x_4=medium)
    Then iris **versicolor**

r₂: If (x_3=short ∨ medium) and (x_4=short) Then iris **setosa**

r₃: If (x_2=short ∨ medium) and (x_3=long) and (x_4=long) Then iris **virginica**

r₄: If (x_1=medium) and (x_2=short ∨ medium) and (x_3=short) and (x_4=long)
    Then iris **versicolor**

   Your assignment now is to implement this fuzzy classifier in a computer program, and you have to then apply your program to classify all the iris data and examine the classification accuracy of your fuzzy system.

   Your report has to cover the key parts as follows:

1. What is the AND operator in your implementation?
2. What is the OR operator in your implementation?

3. What is the data flow from inputs to decision given the normalized attribute values as (0.3, 0.8, 0.2, 0.7)? You have to make fuzzy reasoning with hand at this stage. This is a preparation stage to help you make sure that you understand the whole fuzzy reasoning procedure. As long as you truly understand, you will find implementation with programming easy and enjoyable.

4. What is the accuracy of your implemented fuzzy classifier on the Iris data?