

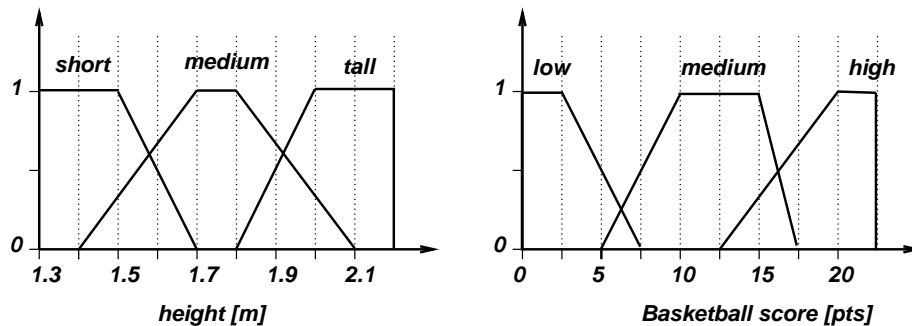
CSE 6369 - Reasoning with Uncertainty

Homework 1- Fall 2015

Due Date: Sep. 24 2015, 11:59 pm

Fuzzy Logic

1. A Fuzzy logic inference system is used to determine the number of points scored by a particular player in a Basketball game. The score is assumed here to depend largely on the height of the player (this system is by no means assumed to be realistic). The inference system uses two linguistic variables (*height* and *Basketballscore*). Each of these can belong to three possible sets (*short*, *medium*, and *tall* for *height* - *low*, *medium*, and *high* for *Basketballscore*). The following are the corresponding membership functions:



The controller uses the following fuzzy rules:

if *height* is *short* then *Basketballscore* is *low*

if *height* is *medium* then *Basketballscore* is *medium*

if *height* is *tall* then *Basketballscore* is *high*

Calculate the resulting score membership functions and defuzzified score value for heights of 1.6m and 1.9m using the Mamdani inference system introduced in class.

Probabilities

2. The probability of a program having a major bug that will result in it crashing is 0.3. There are two testing procedures that can be used to detect such bugs. Each of the testing procedures utilizes 60% of the code and the first one detects 50% of all bugs occurring in its code area. The second testing procedure can detect 30% of the bugs occurring in its code area. Both procedures overlap in their evaluation on 50% of the code that they use during evaluation and can therefore both detect the same bugs if they occur in this area. Neither one of the tests will erroneously produce a bug warning and it is assumed that there is at most one major bug in the code and that a major bug is equally likely in all code areas (none of these assumptions is assumed to be realistic for real software testing). How high is the probability that a program does not have a major bug if it passes both testing procedures ?

Dempster Shafer Beliefs

3. Show that in a Dempster Shafer belief system $Bel(U) \leq Plaus(U)$.
4. For a lottery, a colored ball is drawn at random from an urn and then put back. For the lottery, either two balls of each of the three colors red (R), green (G), and blue (B), or two red and one green and one blue ball are placed in the urn.

Use a Dempster Shafer belief system to determine the beliefs for this lottery ($W = \{B_0, B_R\}$, $B_0 =$ unbiased, $B_R =$ biased towards red). In particular, determine the beliefs and plausibilities for the two observed sequences $R B R G B G G$ and $G R B R R G R$. Show the beliefs after every update using the mass density functions below to represent the evidence. ¹

- a) Set the mass densities for the evidence to the conditional probabilities of the particular sets given the color of ball drawn.
- b) Repeat the experiments with a simplified evidence function where evidence 0.1 is added to configuration B_R and no evidence is given to B_0 if a ball of color R is drawn. If any other ball is drawn, evidence 0.05 is given to configuration B_0 and no evidence is given to B_R .

¹Rather than computing all the values by hand it might be simpler to write a short program to compute the mass densities, beliefs, and plausibilities.