TUTORIAL: FUZZY INFERENCES

QUESTION 1

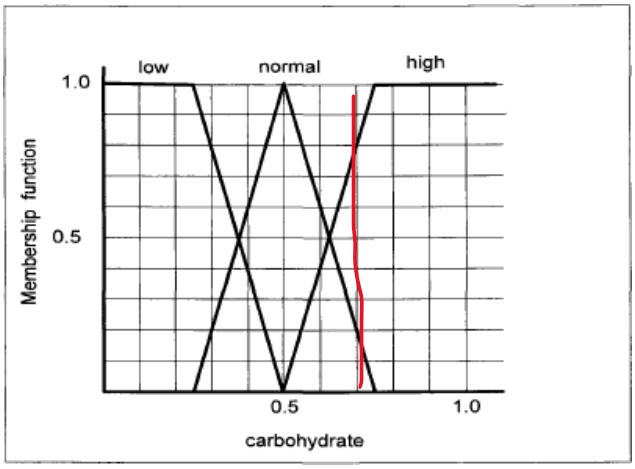
Consider a fuzzy inference system given by the following rules:

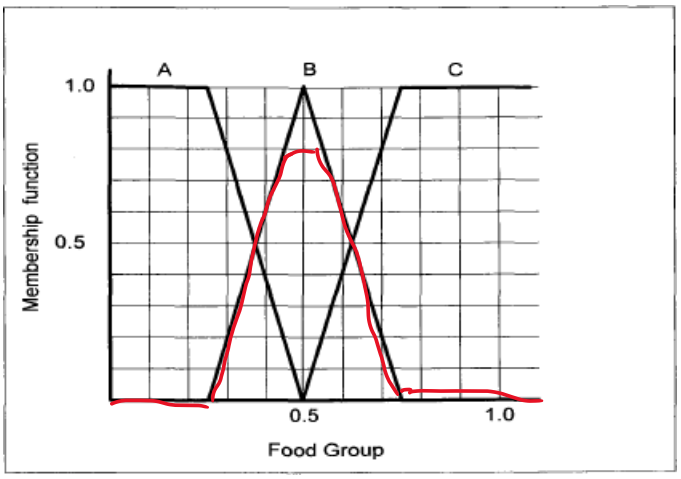
Rule 1: IF Carbohydrate is high AND Fat is high
THEN Food group is A

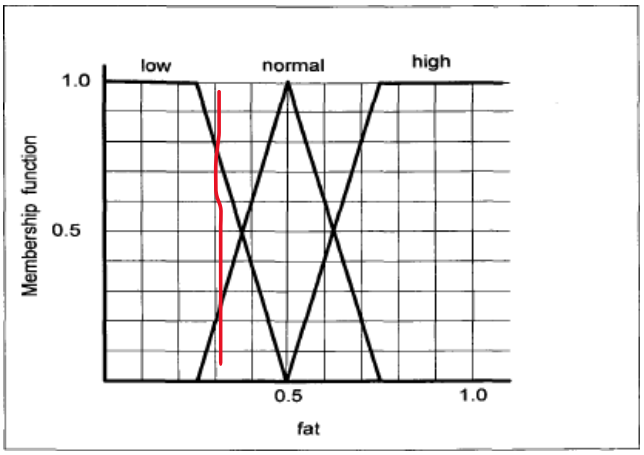
Rule 2: IF Carbohydrate is high AND Fat is low
THEN Food group is B

Rule 3: IF Carbohydrate is low AND Fat is medium
THEN Food group is C

The fuzzy set for all linguistic variables are given in the following graphs:







Fuzzify the input if given that the carbohydrate is 0.7 and Fat is 0.3.

U (carbohydrate = 0.7) -> 0.7 (high)
U (carbohydrate = 0.7) -> 0.2 (normal)
U (carbohydrate = 0.7) -> 0.0 (low)

U (fat = 0.3) -> 0.8 (low)
U (fat = 0.3) -> 0.2 (normal)
U (fat = 0.3) -> 0.0 (high)

Rule 1 = min (0.7,0.0) = 0.0
Rule 2 = min (0.7,0.8) = 0.7
Rule 3 = min (0.0,0.2) = 0.0

Food group A = 0.0
Food group B = 0.8
Food group C = 0.0

CoG : (0.3*0.2)+ (0.4*0.6)+(0.5*0.8)+(0.6*0.6)+(0.7*0.2)+(0.8*0.0) /(0.2+0.6+0.8+0.6+0.2+0.0)
:1.2/2.4
:0.5

QUESTION 2

Given the following rules, show the fuzzy inferences for all the rules and the aggregation if temperature is 65 and pressure is 30. Show the inference processes and come out with the velocity.

Rule 1:
IF temperature is normal
OR pressure is low
THEN velocity is medium

Rule 2:
IF temperature is normal
AND pressure is normal
THEN velocity is low

Rule 3:
IF temperature is high
THEN velocity is high

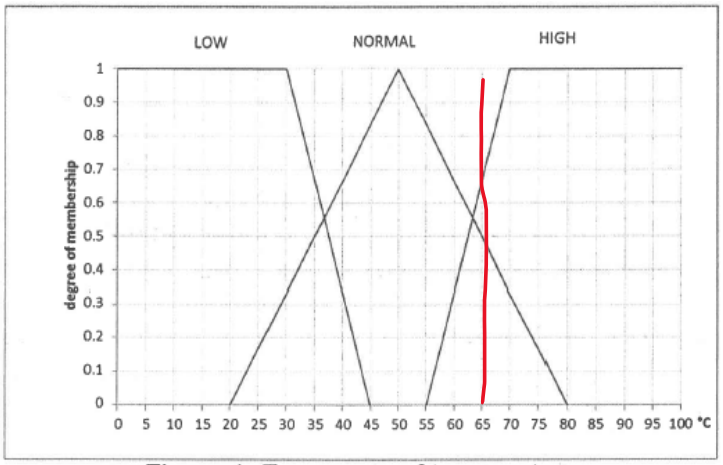


Figure 1. Fuzzy sets of temperature

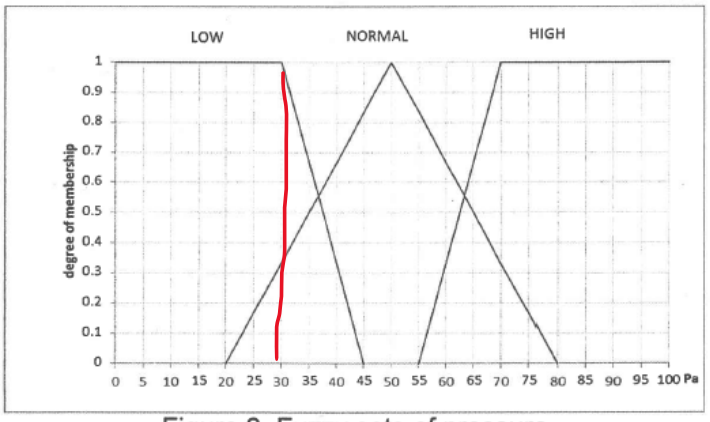


Figure 2. Fuzzy sets of pressure

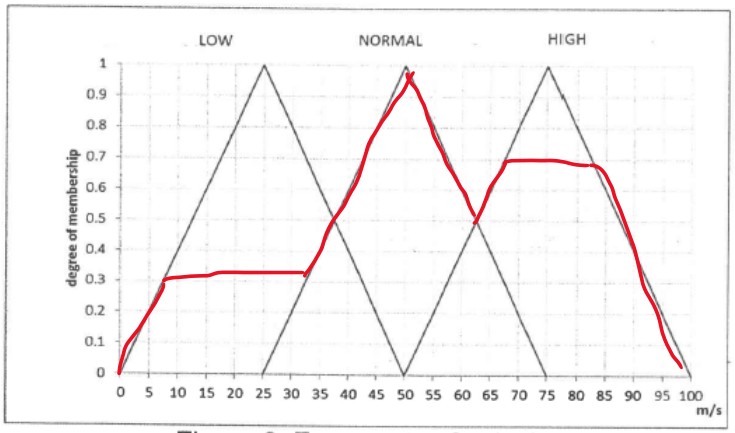


Figure 3. Fuzzy sets of velocity

u (temp = 65) -> 0.5 (normal)
u (temp = 65) -> 0.7 (high)
u (temp = 65) -> 0.0 (low)

u (pressure = 30) -> 1.0 (low)
u (pressure = 30) -> 0.3 (normal)
u (pressure = 30) -> 0.0 (high)

Rule 1 = max (0.5,1.0) = 1.0
Rule 2 = min (0.5,0.3) = 0.3
Rule 3 = 0.7

Velocity medium = 1.0
Velocity low = 0.3
Velocity high = 0.7

CoG:(5*0.2)+(10*0.3)+(15*0.3)+(20*0.3)+(25*0.3)+(30*0.3)+(35*0.4)+(40*0.6)+(45*0.8)+(50*1.0)+(55*0.8)+
(60*0.6)+(65*0.6)+(70*0.7)+(75*0.7)+(80*0.7)+(85*0.6)+(90*0.4)+(95*0.2)+(100*0.0)
/(0.2+0.3+0.3+0.3+0.3+0.3+0.4+0.6+0.8+1.0+0.8+0.6+0.6+0.7+0.7+0.7+0.6+0.4+0.2+0.0)

:57.12