BİM466 Fuzzy Logic – Homework 1

Simulation of a inverted pendulum system with a fuzzy controller shown by Fig. 1 Pendulum is hold in vertical position and its difference equations for small oscillations is given by:

$x_1(k+1) = x_1(k) + x_2(k)$

$x_2(k+1) = x_1(k) + x_2(k) – u(k)$

where x_1 is the vertical deviation angle (θ), x_2 is the change of deviation angle at unit time ($\Delta\theta$) and u is the control input (torque). Domains of x_1, x_2 and u are $[-2^0, 2^0]$, [-5dps, 5dps] and [-24, 24] respectively with the membership functions given in fig. 2. The rule base of the fuzzy controller is given in table 1. Complete the table 2 if the fuzzy controller uses Mamdani's **max-product inference engine** and **weighted average of centroids**.

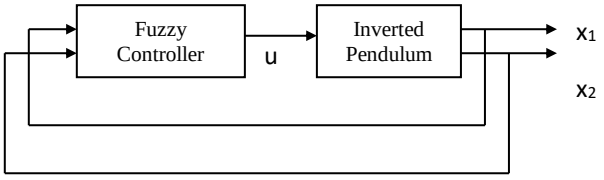
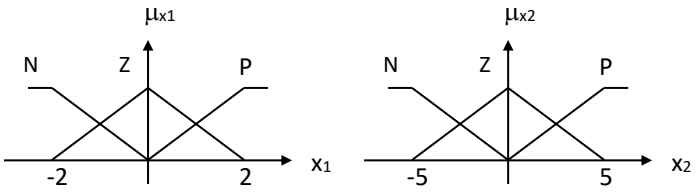


Fig. 1

Table 1

x_1 \ x_2	P	Z	N
P	PB	P	Z
Z	P	Z	N
N	Z	N	NB



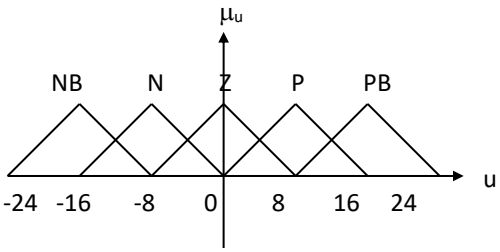


Fig. 2

Table 2

k	$x_1(k)$	$x_2(k)$	u(k)
0	1	-4	
1			
2			