

SEMINAR

FUZZY LOGIC  
ROBOTICS

“Vagueness is no more to be done away with in  
the world of logic than friction in mechanics.”

-CHARLES SANDERS PEIRCE

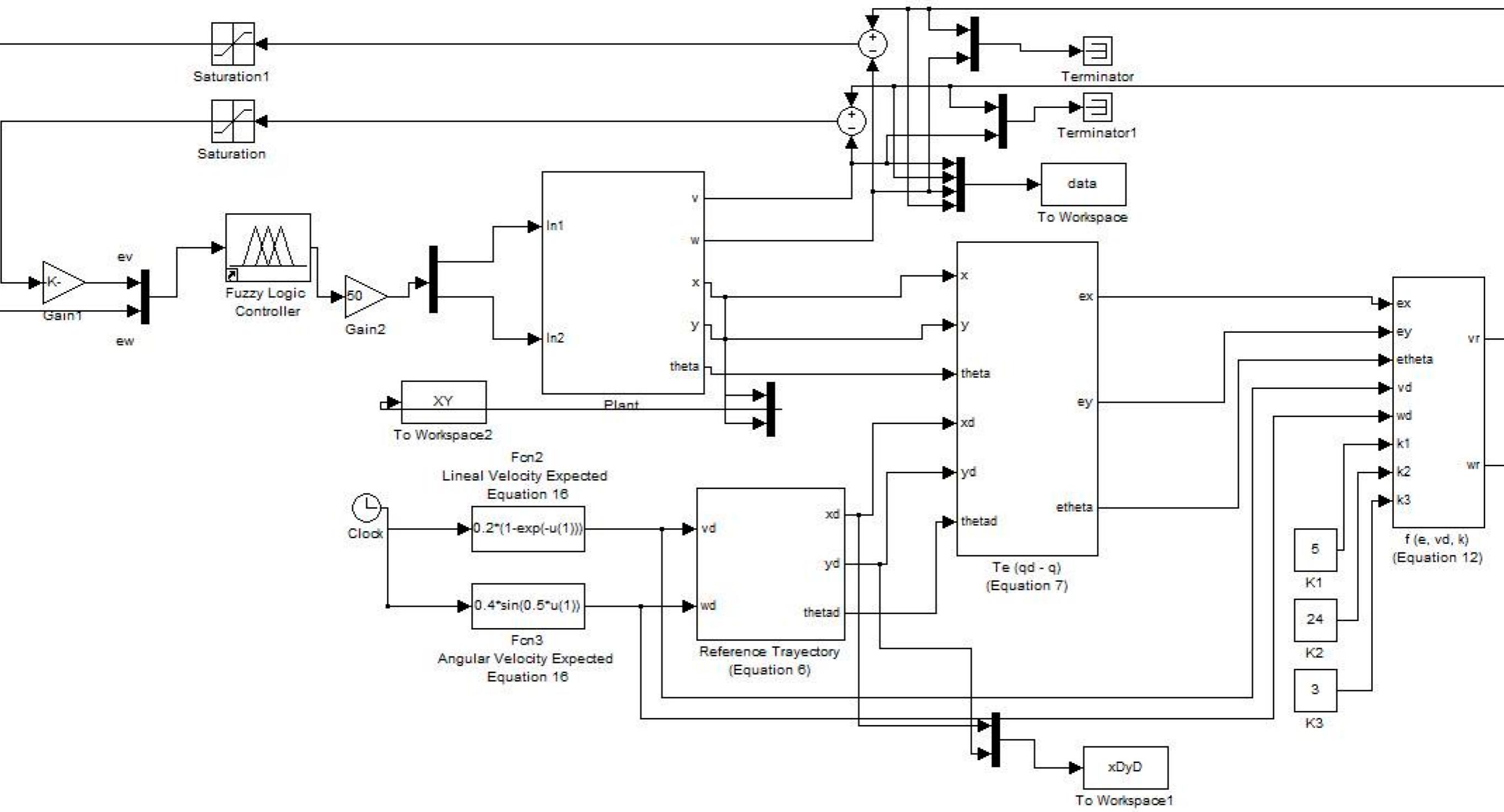


# LIMITLESS POTENTIAL

IN THE FIELD OF ROBOTICS

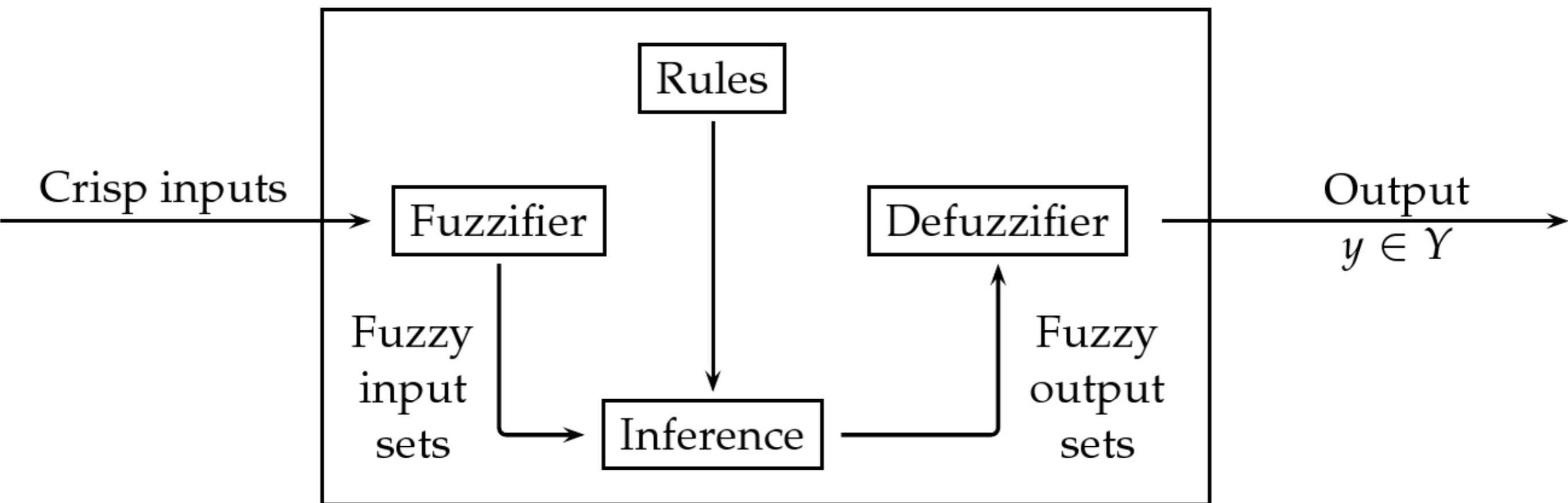
WHAT ARE

# FUZZY CONTROLLERS



A fuzzy control system is a control system based on fuzzy logic.

### BASIC WORKING OF A FUZZY CONTROLLER

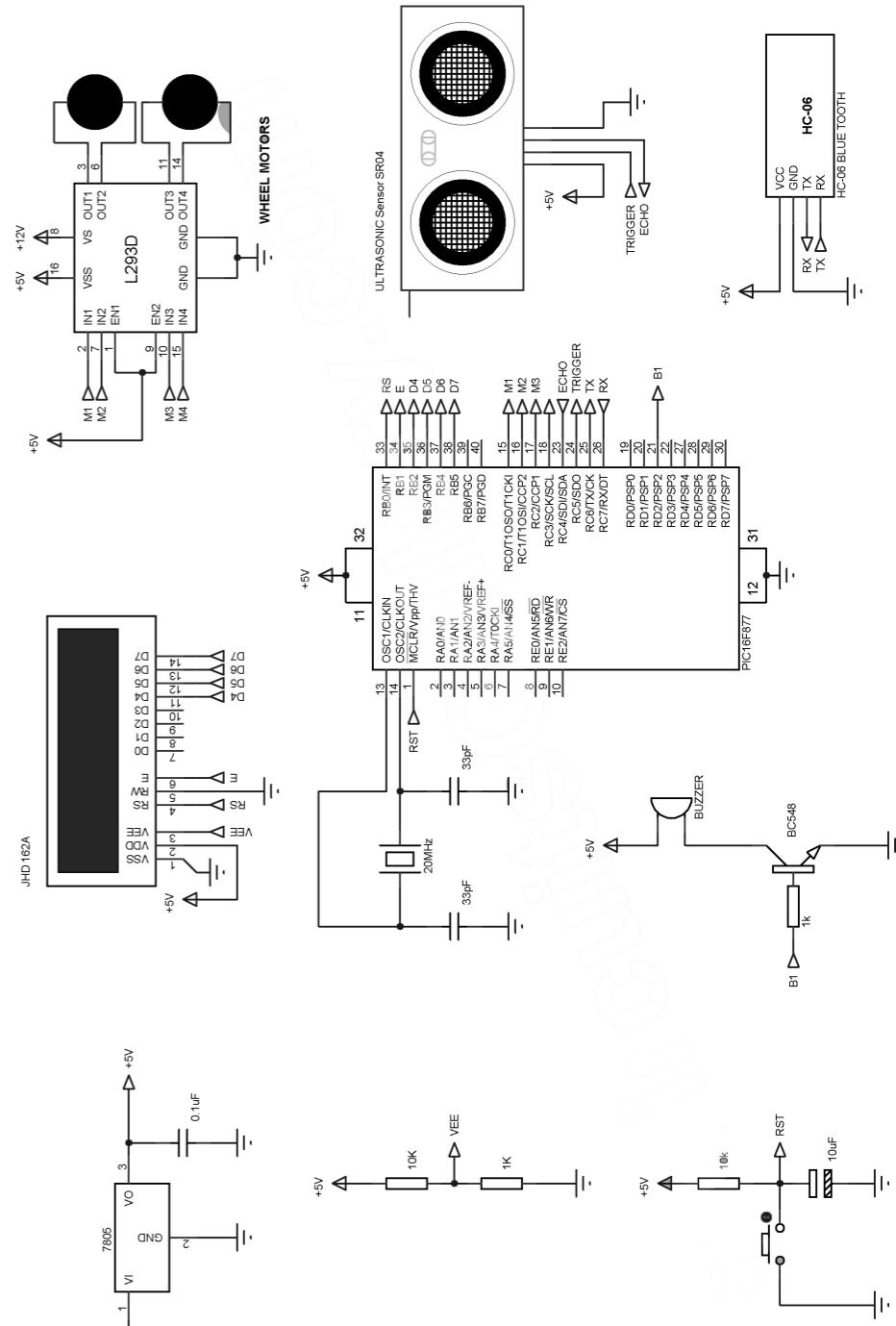
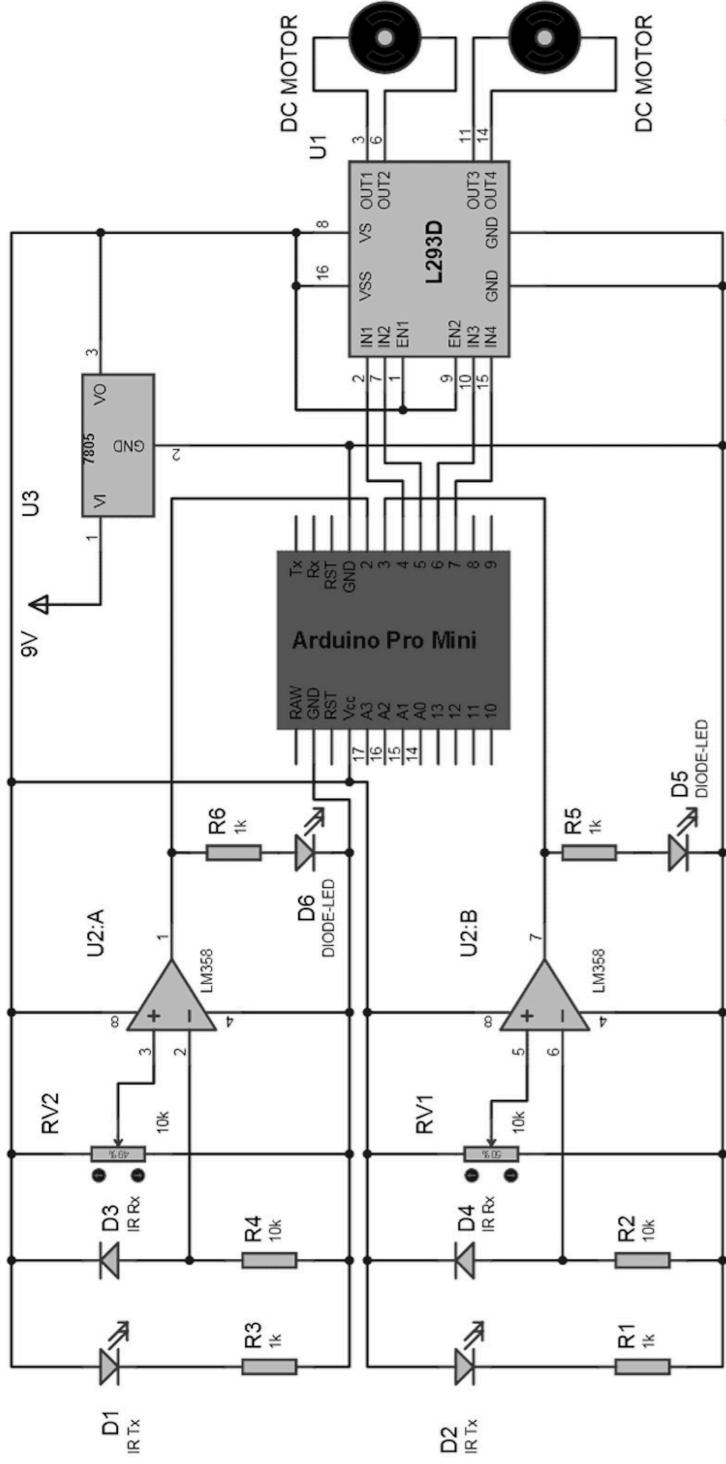


# AUTONOMOUS ROBOT

A programmable and multi-functional machine  
with sensors to execute flawless navigation.

# FUZZY LOGIC CONTROLLER

# ROBOT NAVIGATION



CHARACTERISTIC

LINE FOLLOWING

BEHAVIOUR

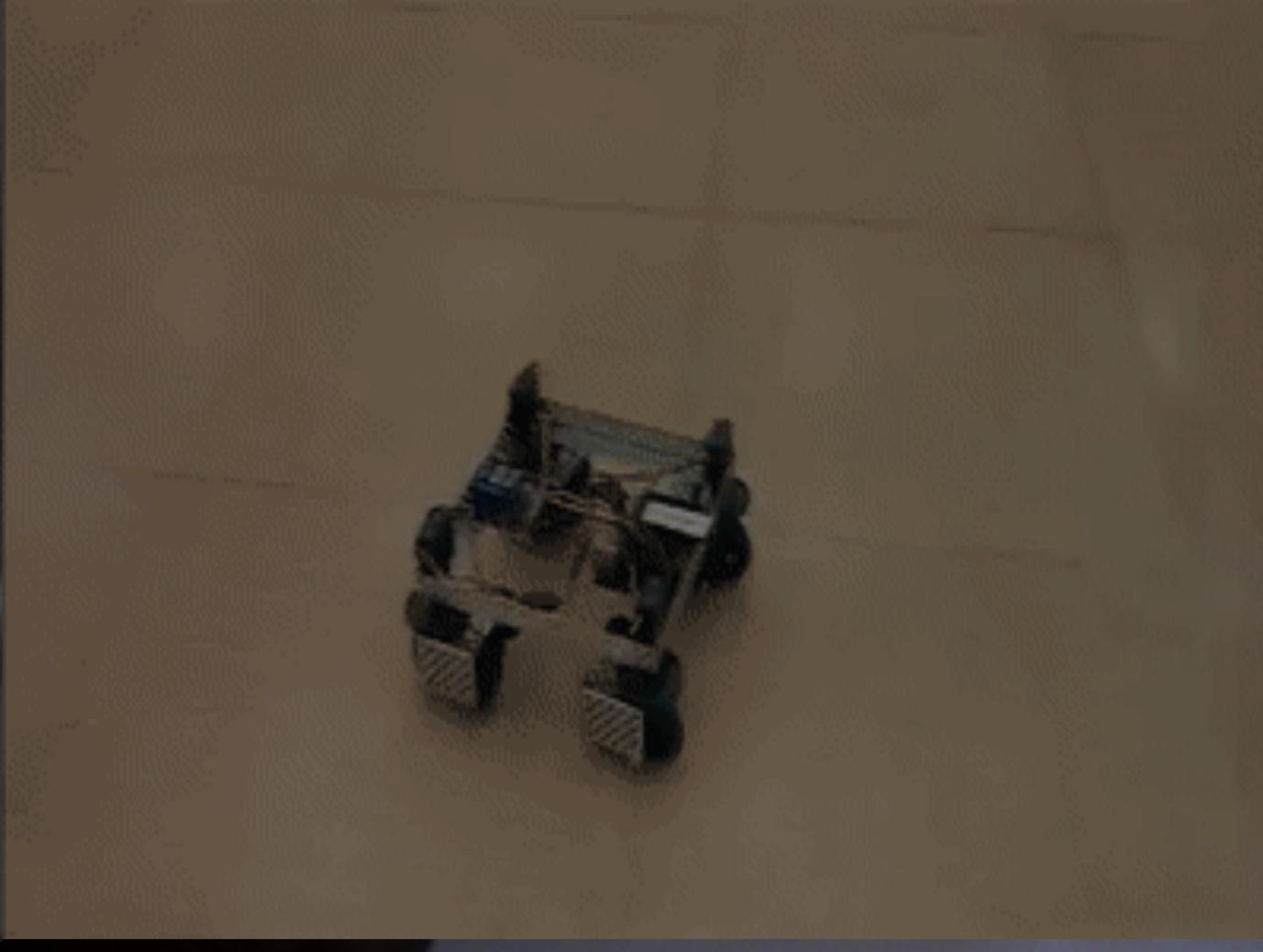
OBSTACLE AVOIDING

METHOD

SWERVING



Following a Line



Avoiding Obstacles



Swerving

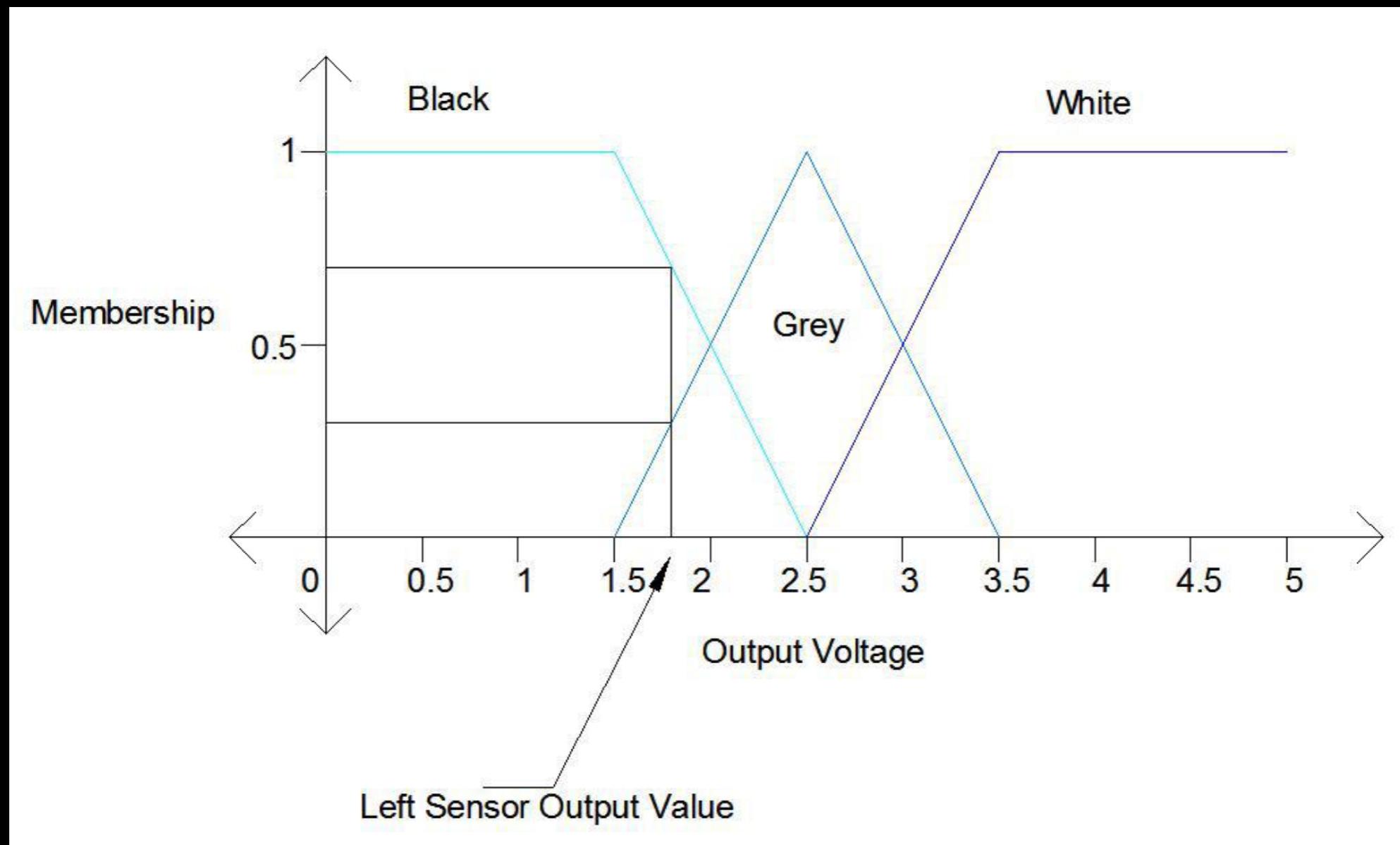
CHARACTERISTIC  
LINE FOLLOWING  
ROBOT

# WHAT IS IT?

A robot that follows a line,  
either a black line on white surface or vice-versa.

HOW?

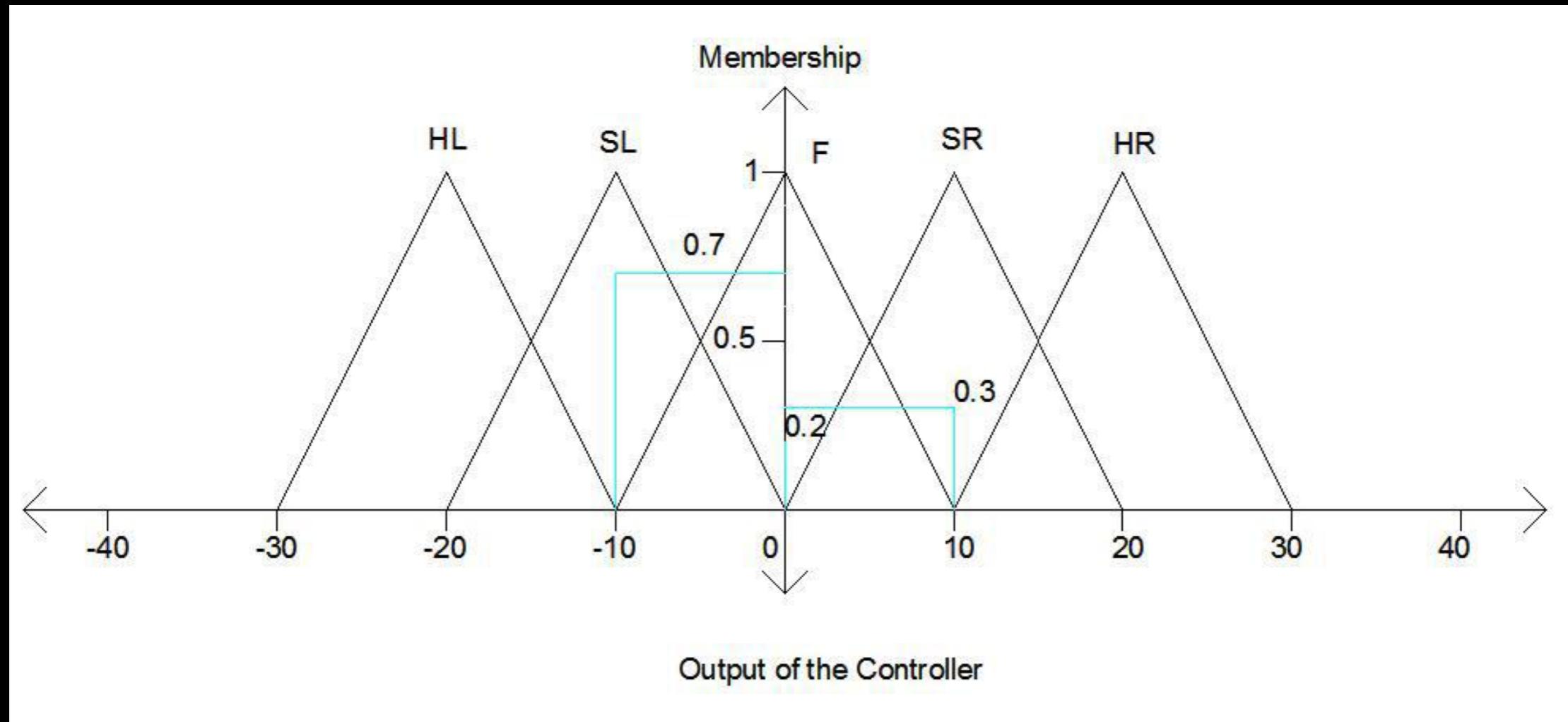
# INPUT FUNCTION



# FUZZY RULE BASE

		RIGHT SENSOR		
		WHITE	GREY	BLACK
LEFT SENSOR	WHITE	S	X	HR
	GREY	X	X	SR
	BLACK	HL	SL	F

# OUTPUT FUNCTION



METHOD

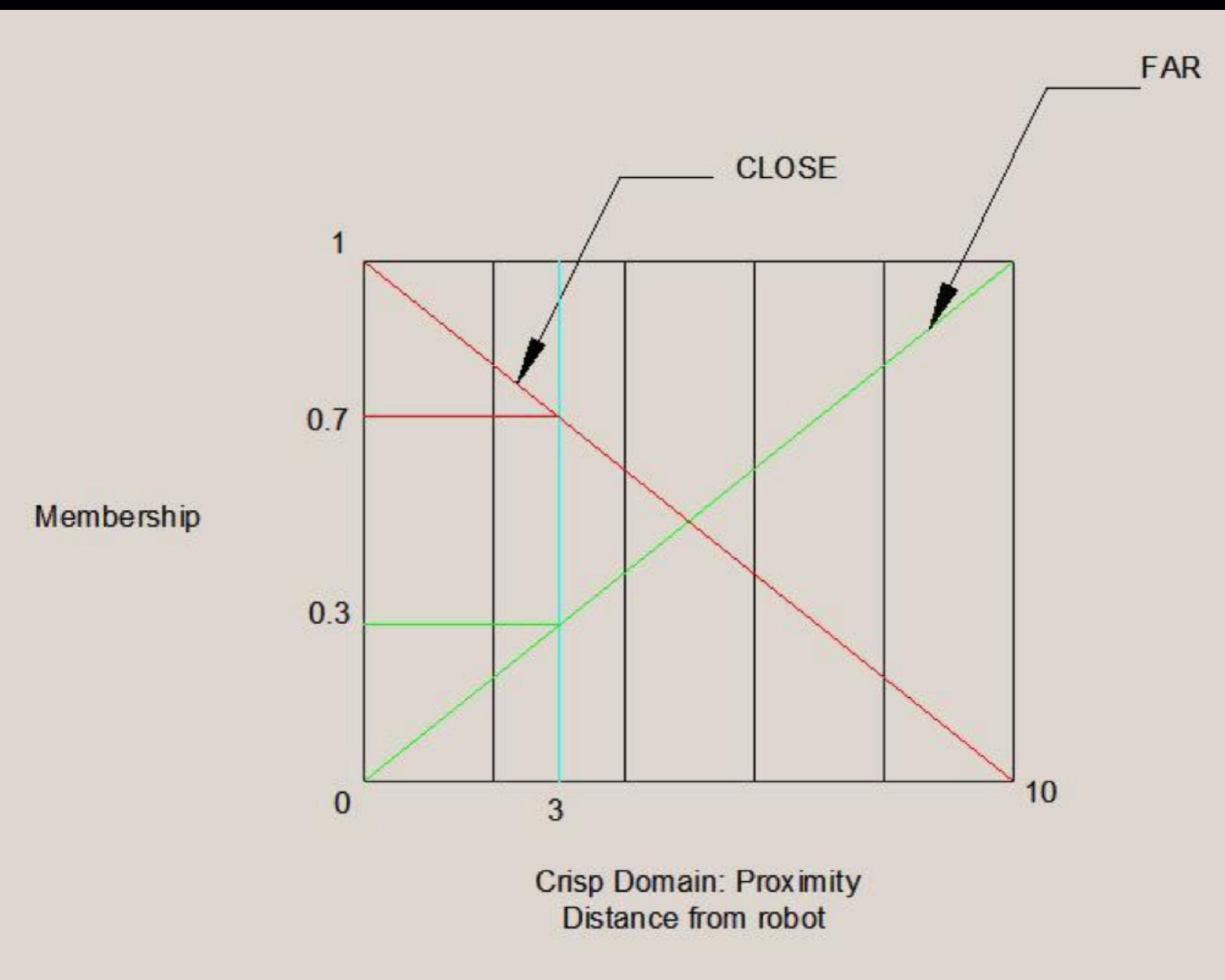
# SWERVING ROBOT

# WHAT IS IT?

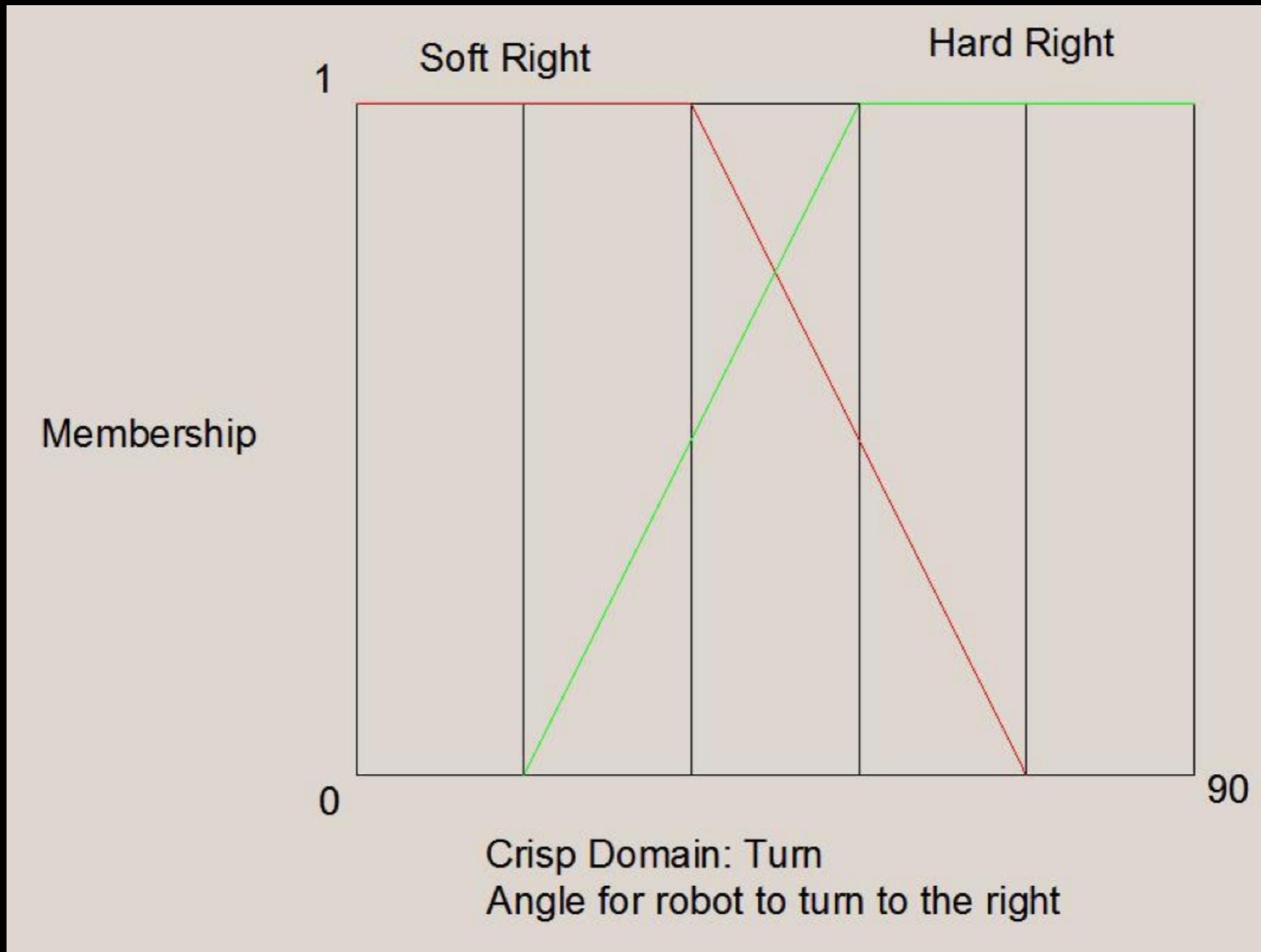
'Swerve' is a behaviour that does not let the robot turn more than 90 degrees from current direction.

HOW?

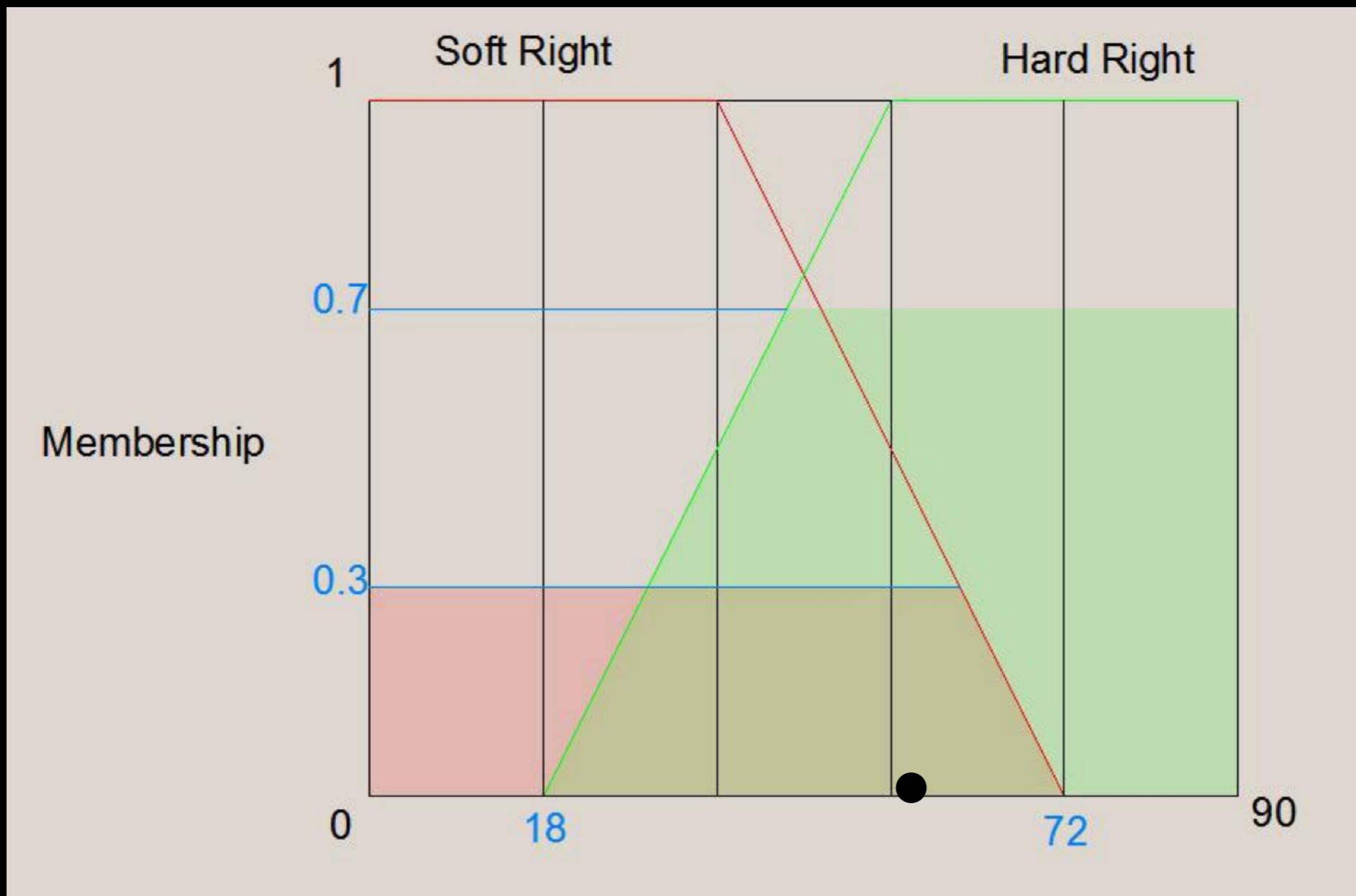
# PROXIMITY INPUT FUNCTION



# TRANSITION

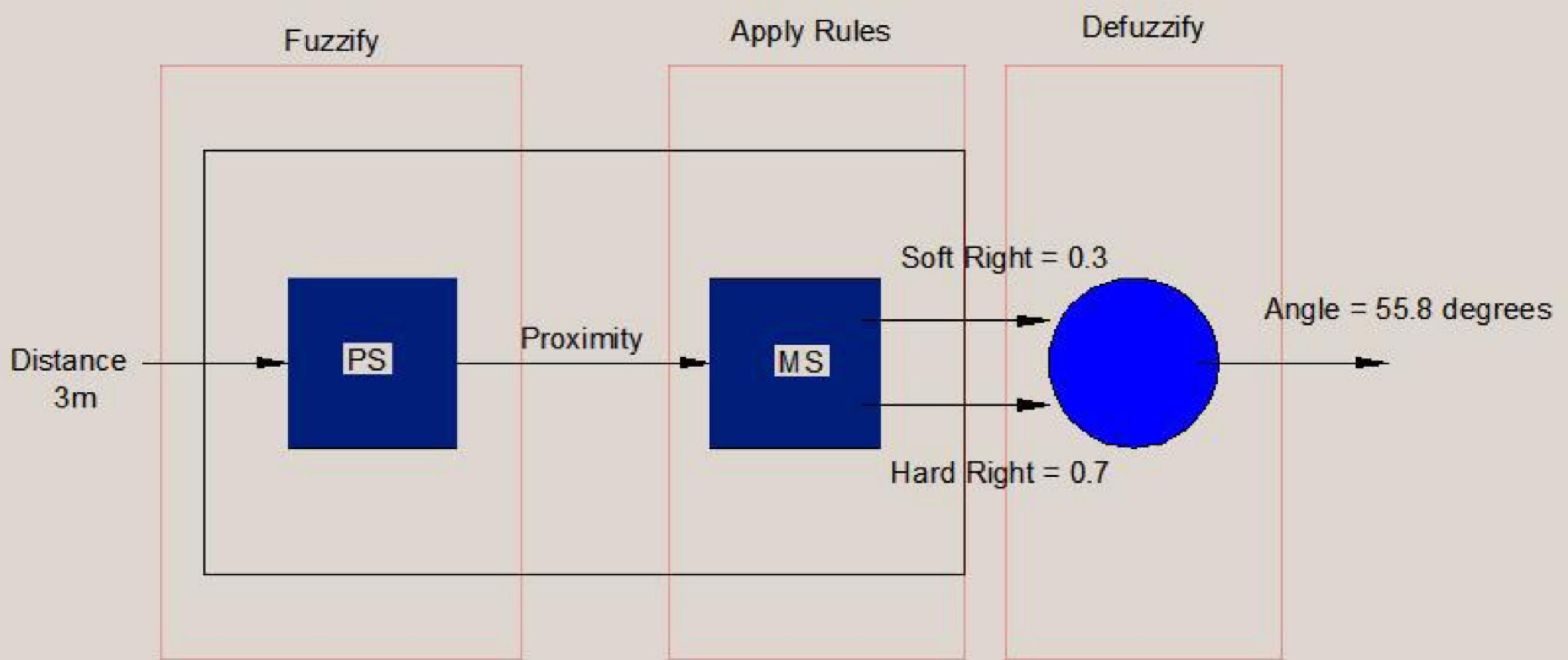


# DEFUZZIFICATION



$$\text{Turn} = (0.3*18 + 0.7*72) / (0.3 + 0.7) = 55.8 \text{ degrees}$$

# WHOLE PROCESS



BEHAVIOUR

OBSTACLE AVOIDING  
ROBOT

# WHAT IS IT?

A robot that moves around obstacles  
based on how close it is to those obstacles.

HOW?

# DISTANCE

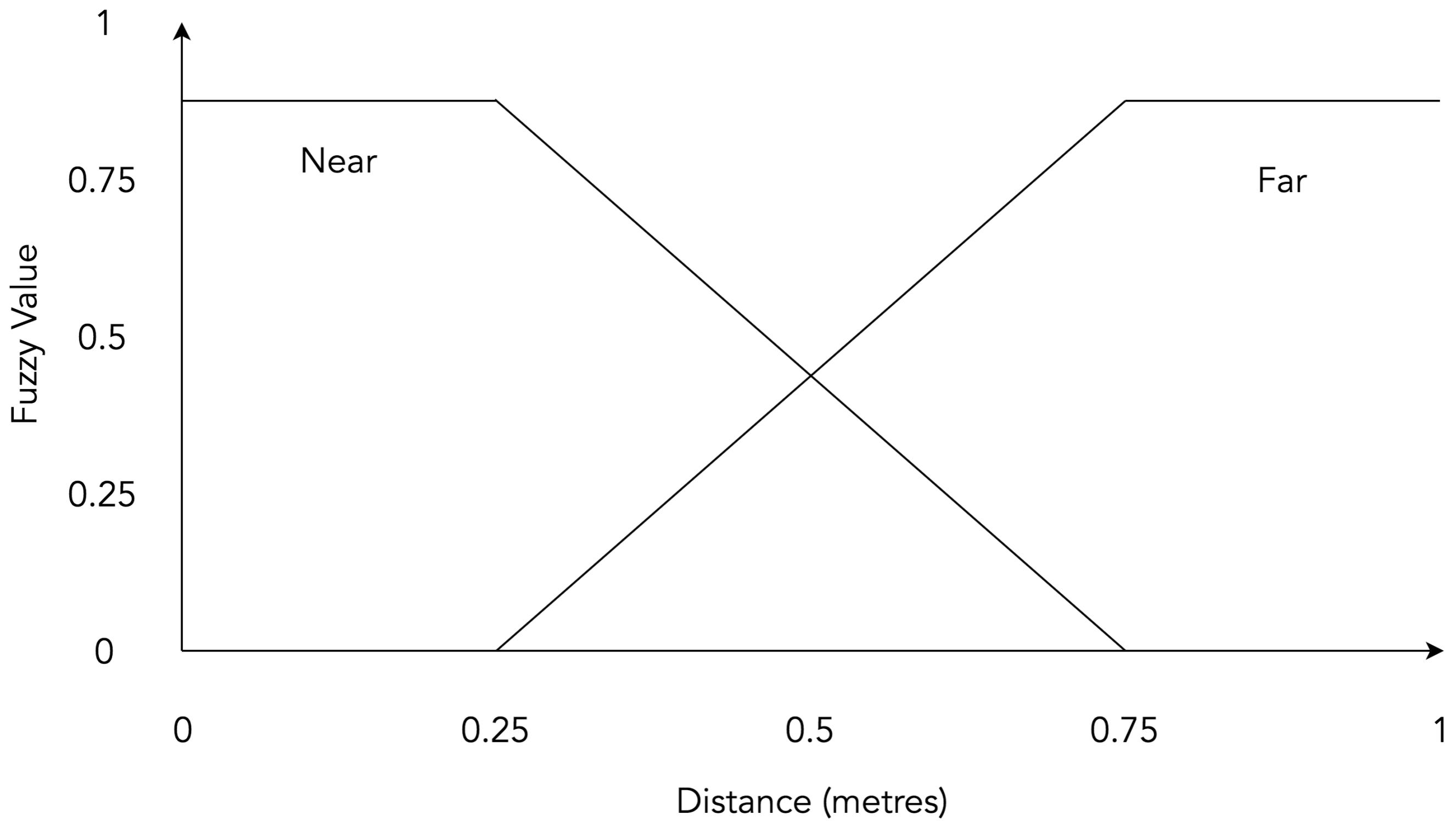
CONTROLS SPEED

THREE VARIABLES

CONTINUOUS MONITORING FOR CALCULATIONS

DISTANCE

# FUZZY INPUT



# DIRECTION

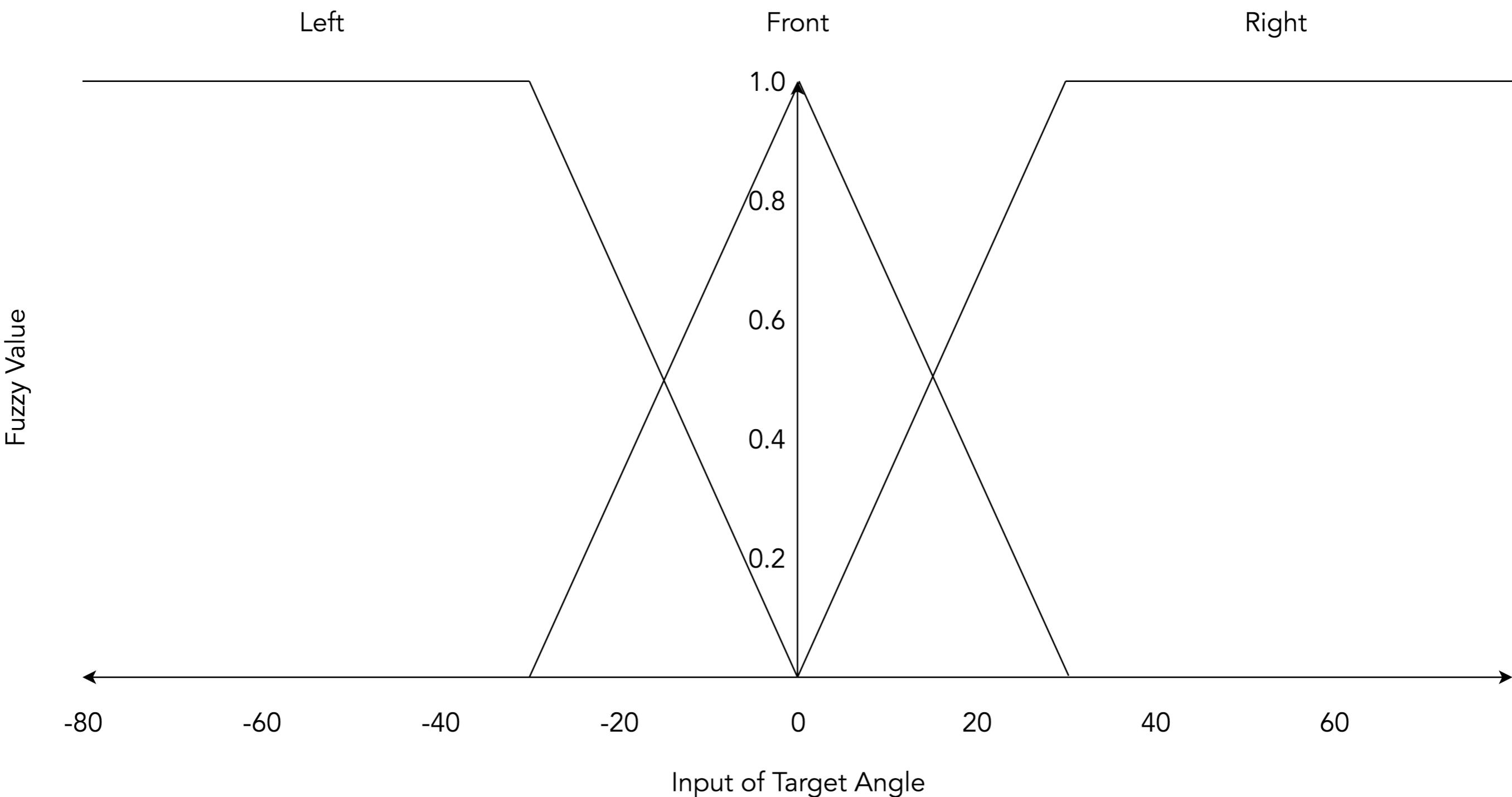
DEPENDS ON HEADING AND ANGLE

TRAJECTORY ADJUSTMENT

CONTINUOUS MONITORING FOR CALCULATIONS

DIRECTION

# FUZZY INPUT



DIRECTION INPUT

# BETTER ALTERNATIVE

Precise

Reused

Simple

# FUZZY RULE BASE

RULE	LEFT	CENTER	RIGHT	ROTATION
1	NEAR	NEAR	NEAR	RIGHT BIG
2	NEAR	NEAR	FAR	RIGHT SMALL
3	NEAR	FAR	NEAR	NO TURN
4	NEAR	FAR	FAR	RIGHT SMALL
5	FAR	NEAR	NEAR	LEFT SMALL
6	FAR	NEAR	FAR	RIGHT BIG
7	FAR	FAR	NEAR	LEFT SMALL
8	FAR	FAR	FAR	NO TURN

# MOTOR OUTPUT

To take a small right turn, the left motor must stop and the right motor must rotate in the forward direction.

For a big right turn, the left motor must rotate in the reverse direction while the right motor continues its forward motion.

ROTATION OUTPUT

# MEMBERSHIP FUNCTION

Big Left

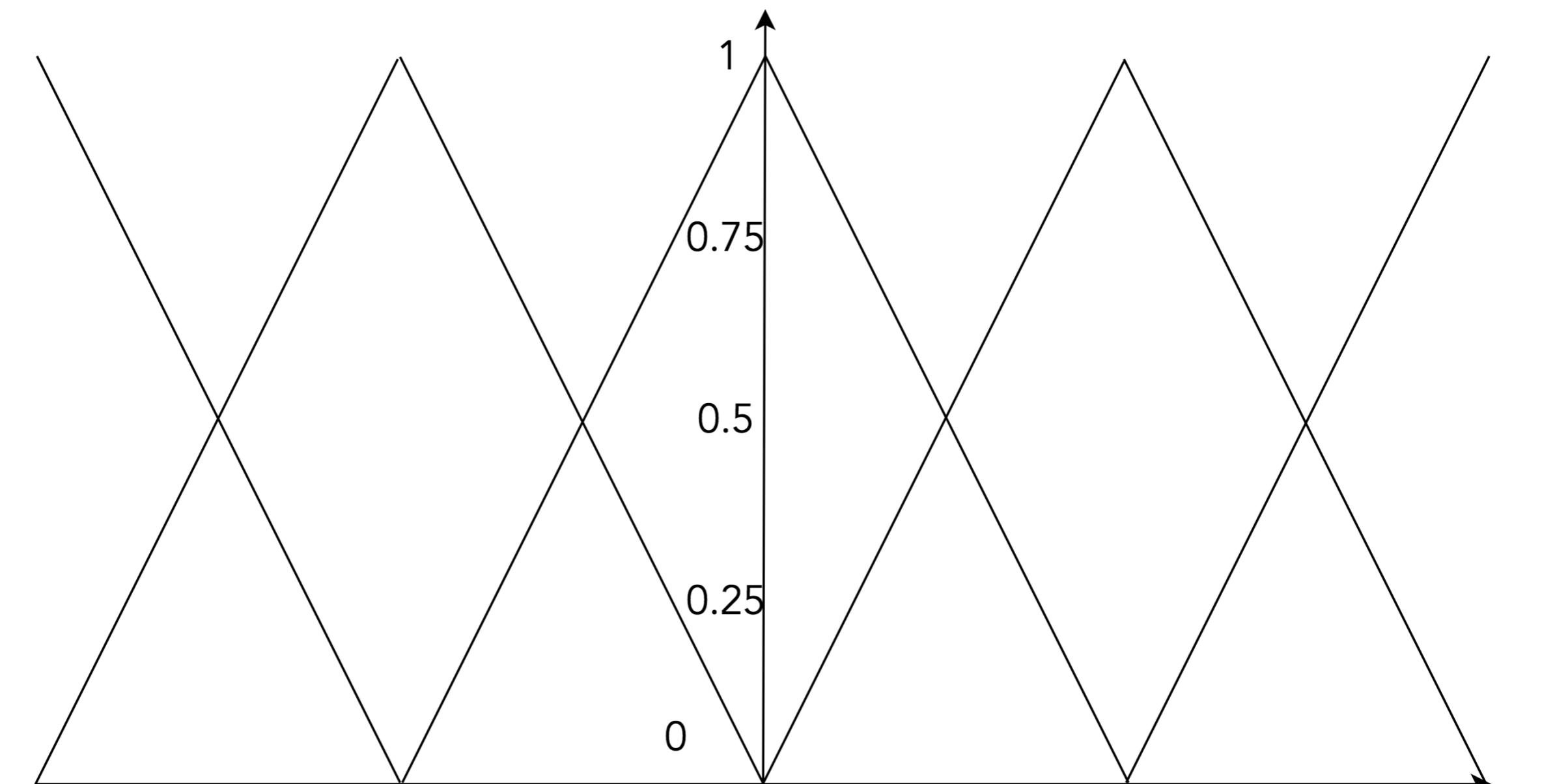
Small Left

No Turn

Small Right

Big Right

Fuzzy Value



-50

-25

0

25

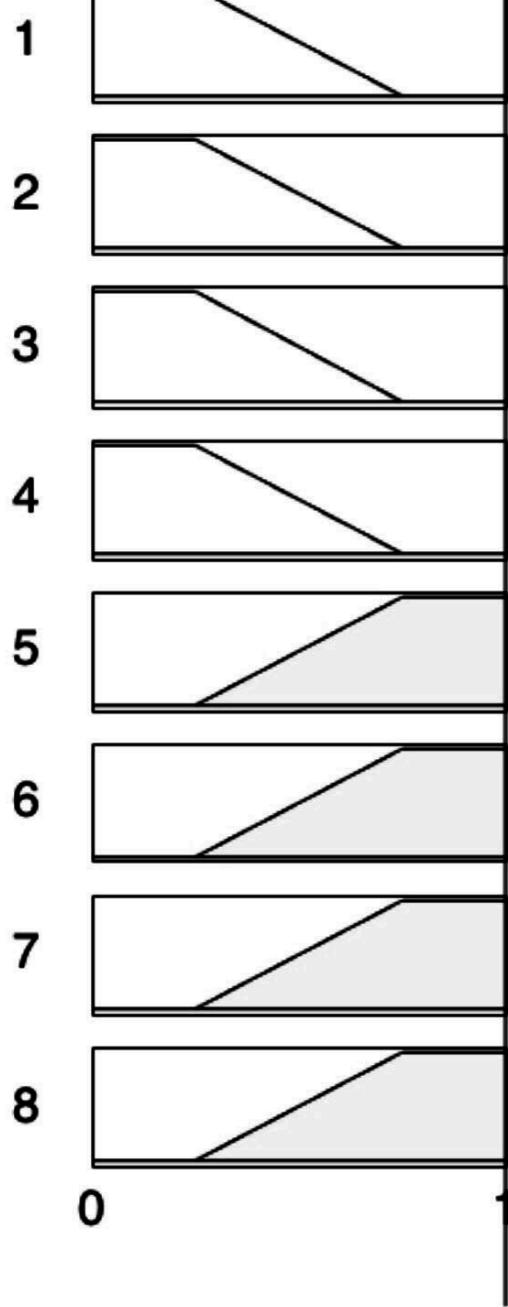
50

Rotational Delta (difference in PWM signals)

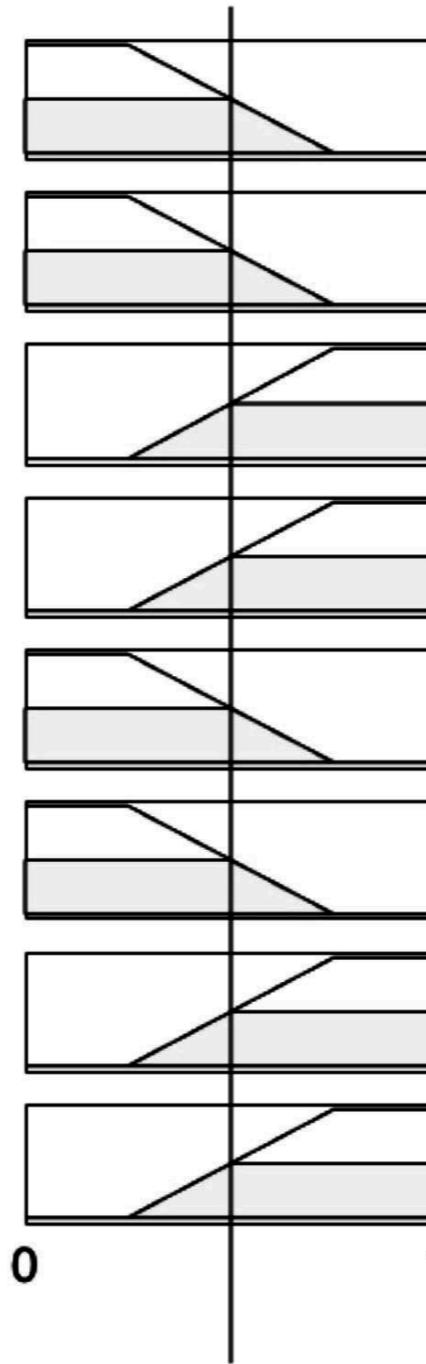
# SAMPLE

1

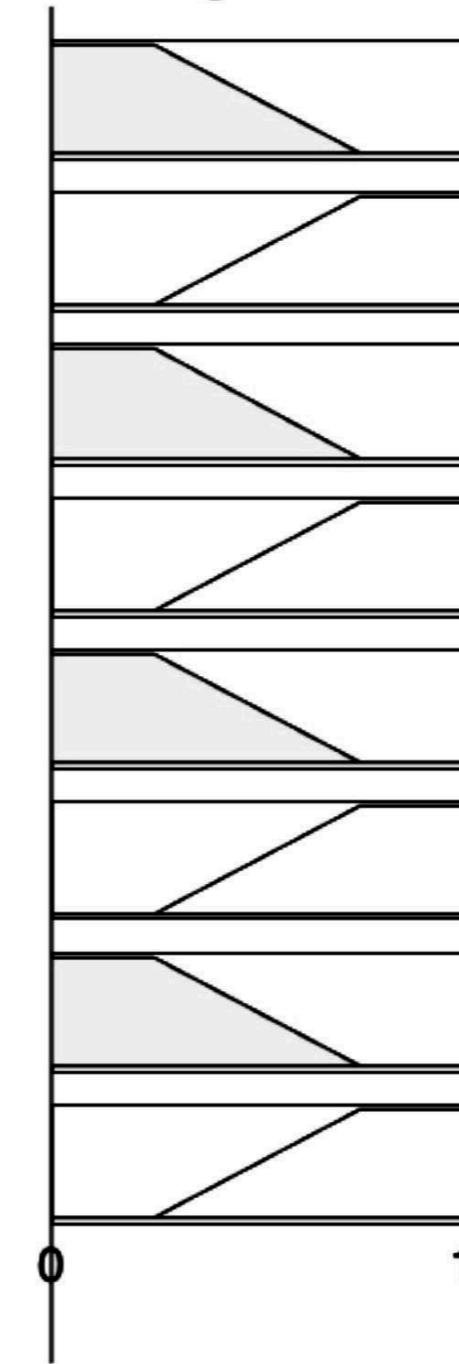
**Left = 1**



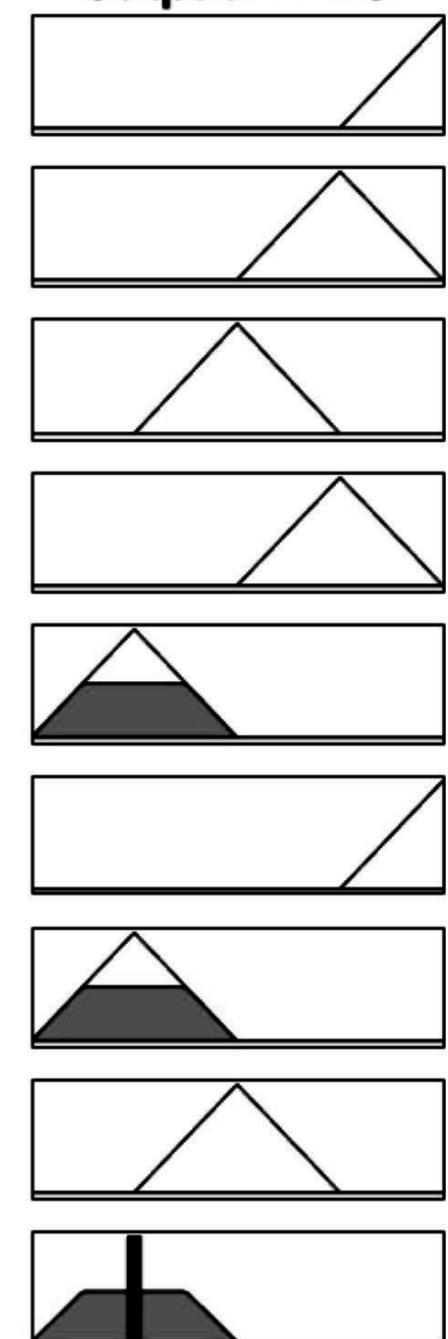
**Center = 0.5**



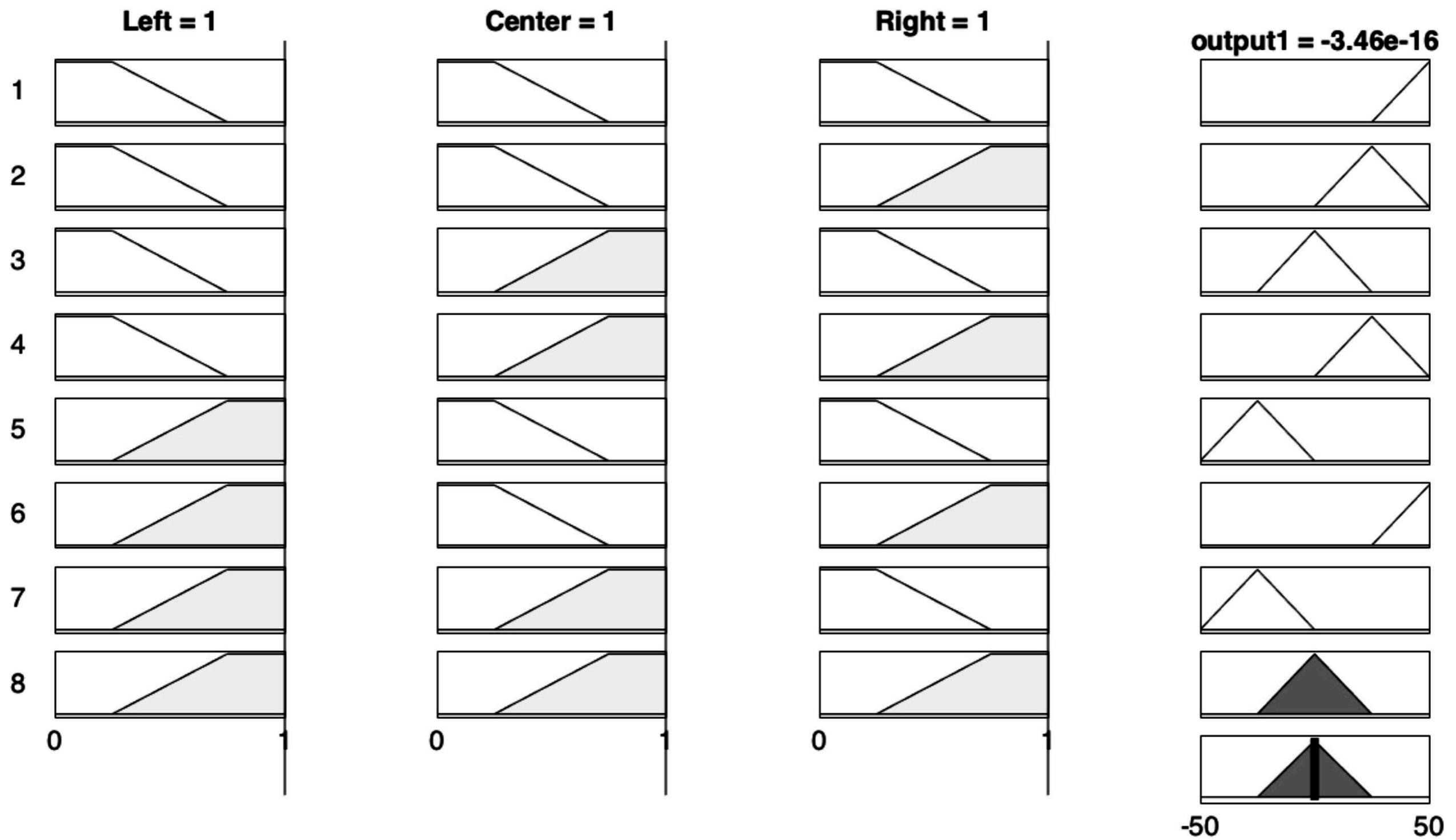
**Right = 0**



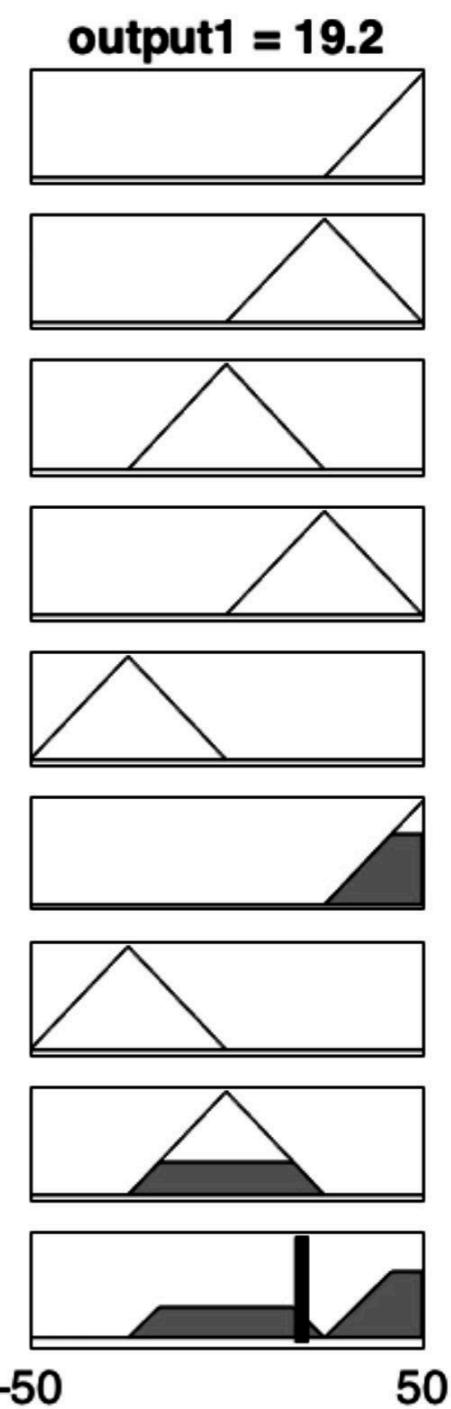
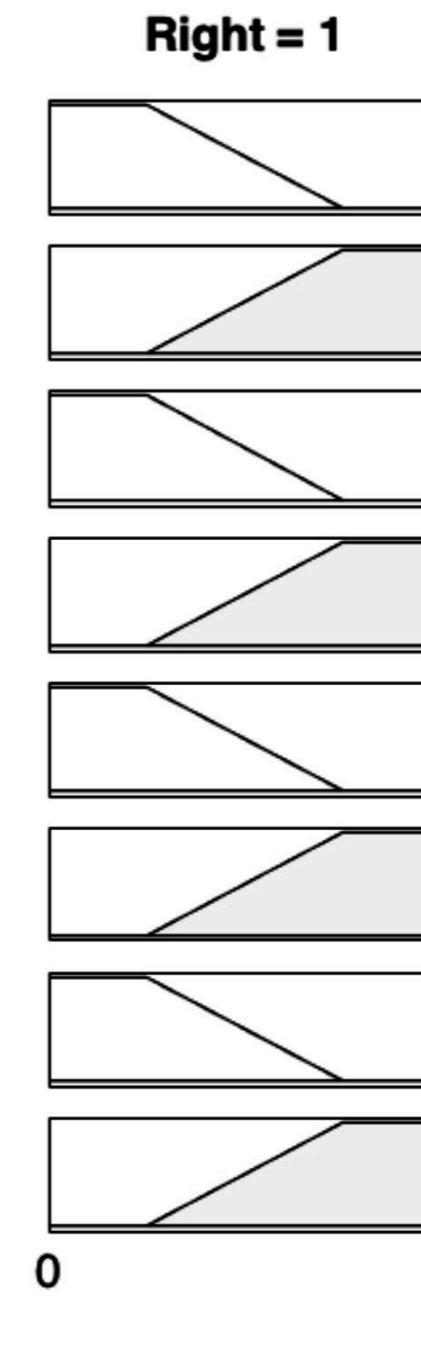
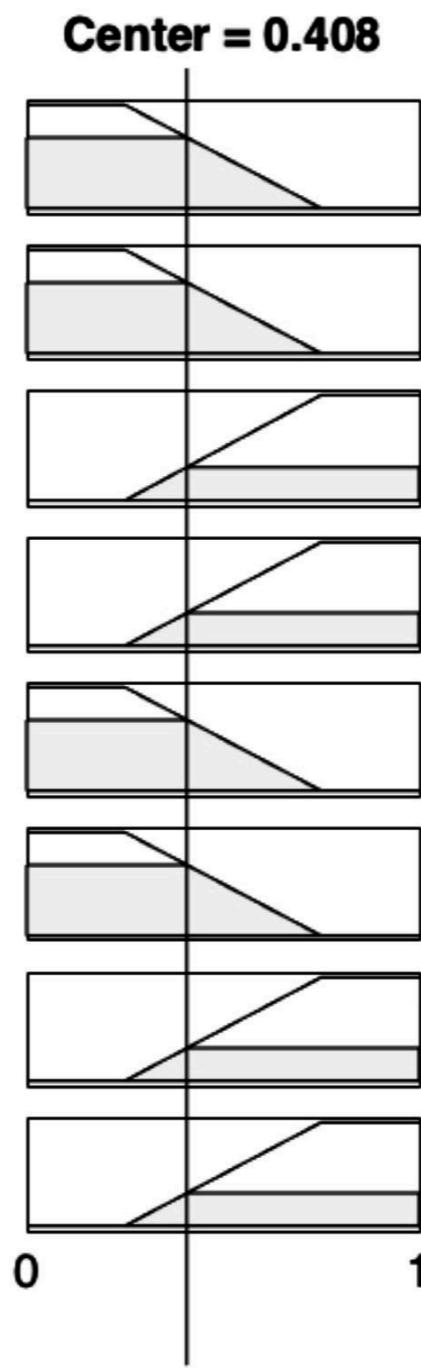
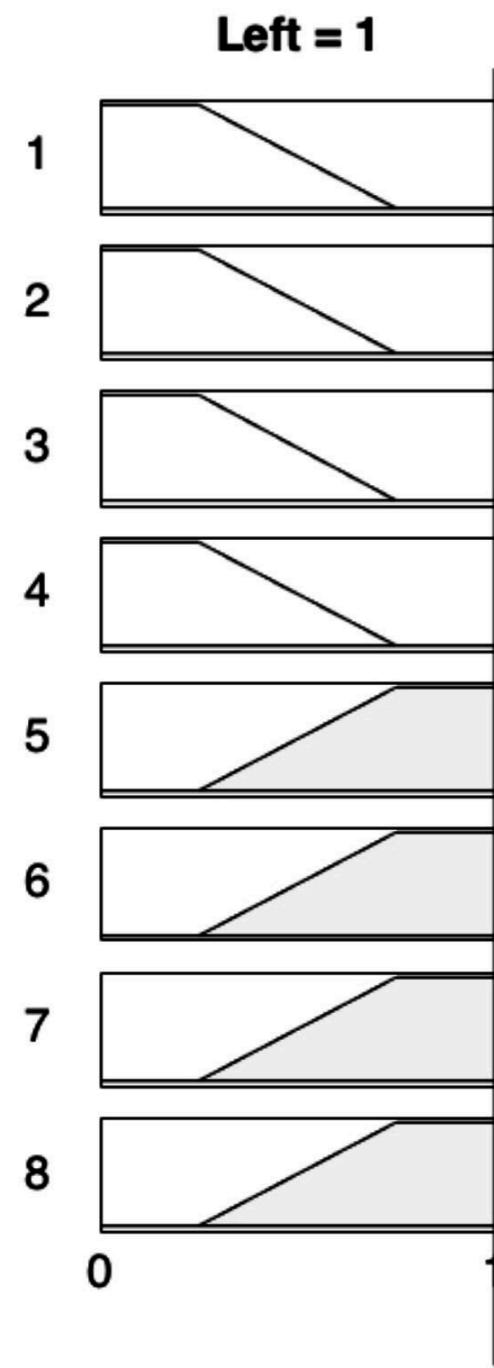
**output1 = -25**



# SAMPLE 2

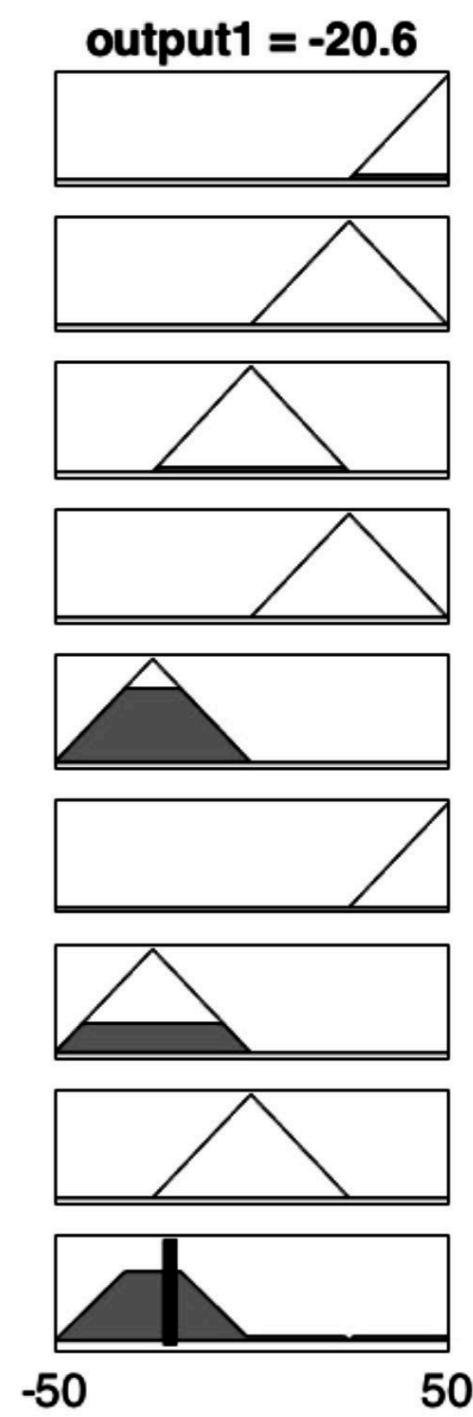
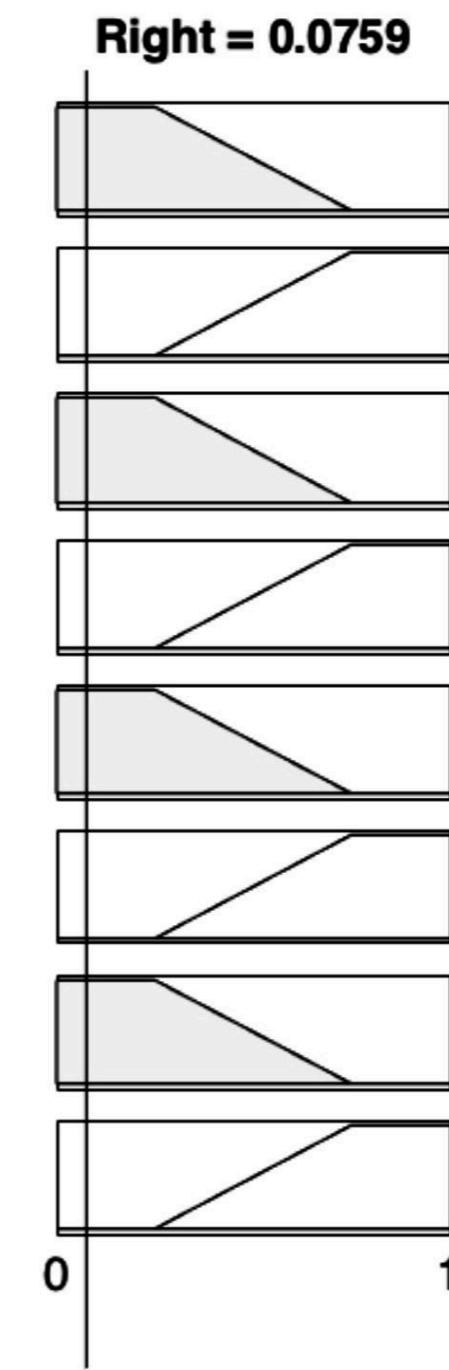
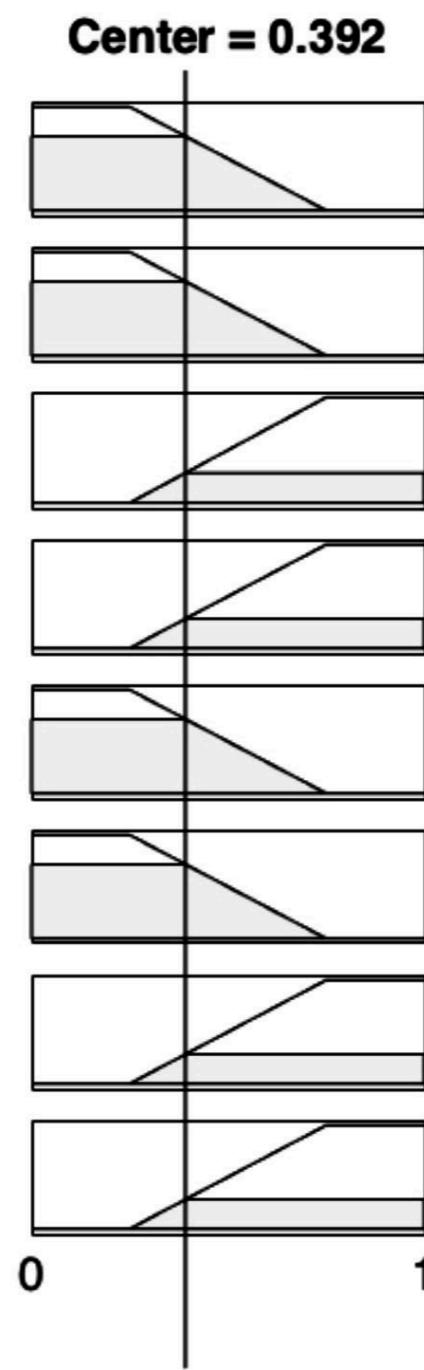
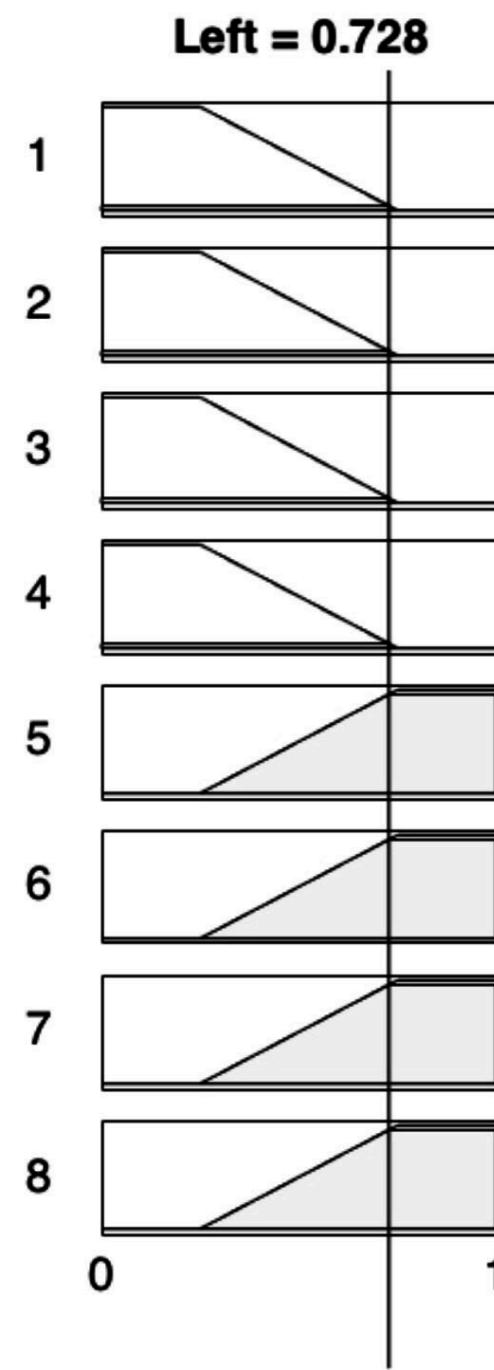


SAMPLE  
3



SAMPLE

4



# PRESENTED BY



2015B4A7436P  
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Thank You.