



**Faculty of Technology and Engineering**  
**Chandubhai S Patel Institute of Technology**  
**Department of Computer Science & Engineering**

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**Laboratory Manual**

Academic Year	:	2022-23	Semester	:	5
Course code	:	CS341	Course name	:	Artificial Intelligence
Name	:	Parth Tandel	Seat Number	:	20CS093

**Performa for PRACTICAL**

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**Aim:**

Design a controller to determine wash time of a domestic washing machine.

Assume the input is dirt and grease on cloths.

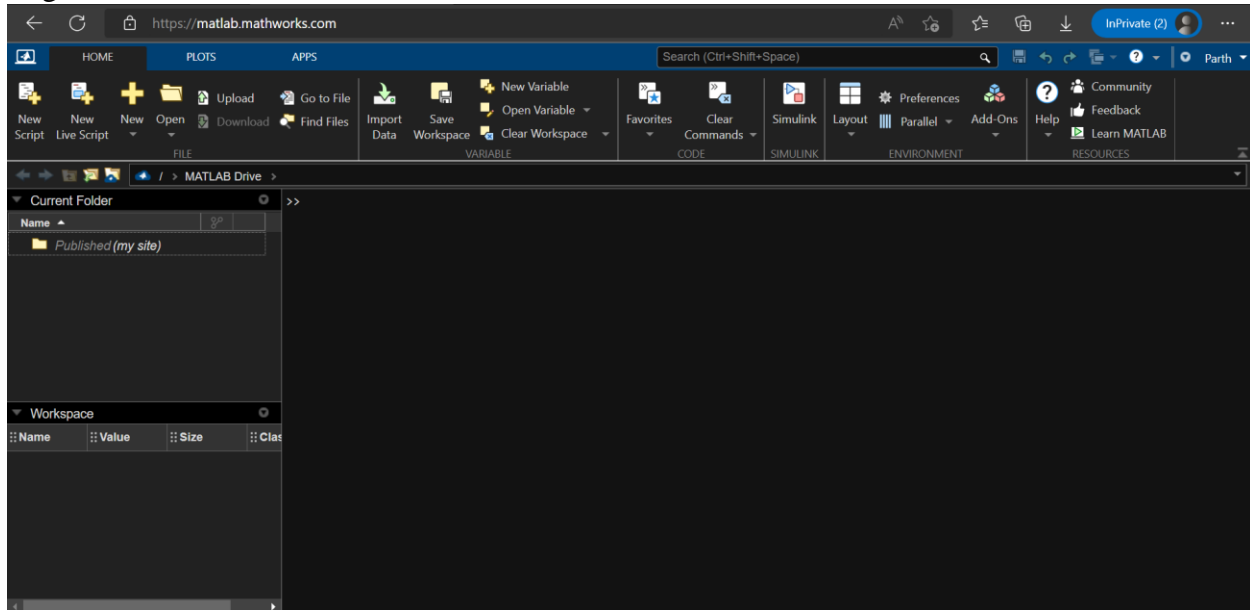
Use three descriptors for input variables and five descriptors for output variables.

Derive the set of rules for controller action and defuzzification. The design should be supported by the figure wherever possible.

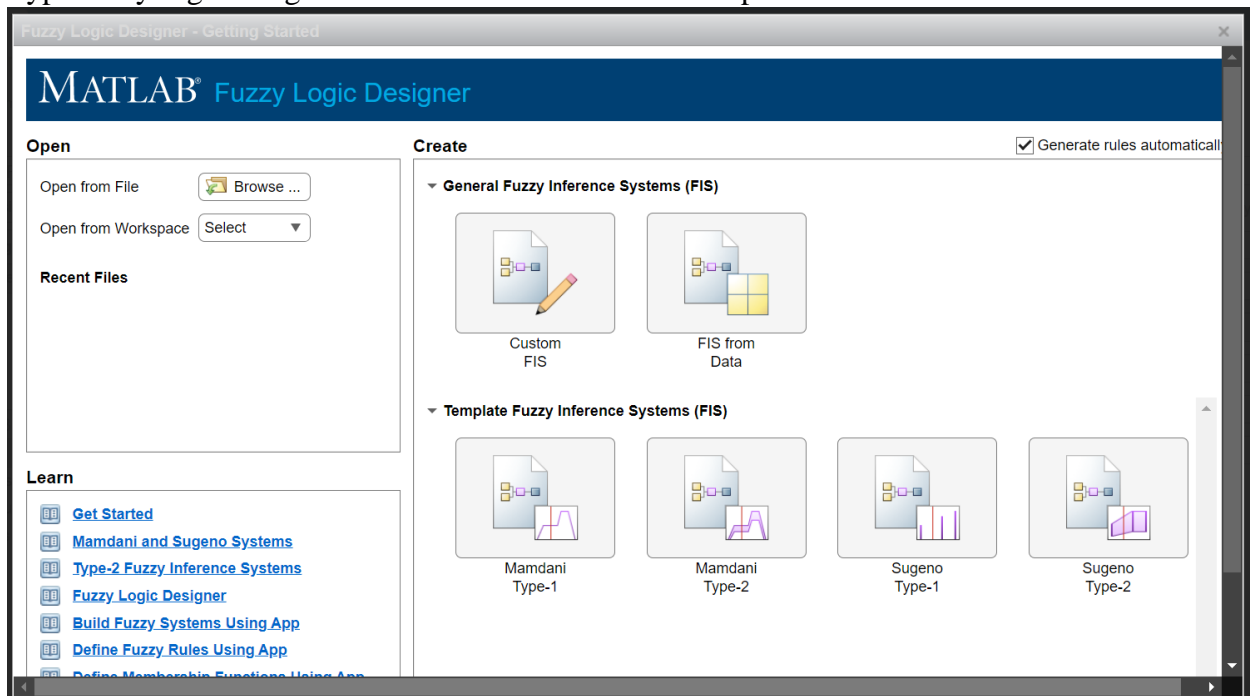
Show that if the cloths are solid to a larger degree the wash time will be more and vice versa.

**Practical:**

Login at Online Matlab.



Type fuzzyLogicDesigner at console. A window would open.



## Select Mamdani Type-1

Fuzzy Logic Designer: mamdanitype1

DESIGN

FILE: New, Save, Import

ADD COMPONENTS: Input, Output, Rule, Add All Rules

CONVERT FIS: Mamdani to Sugeno, Type-1 to Type-2

SIMULATION: Rule Inference, Control Surface

DESIGNS: Store Current Design, Export

Number of Samples: 101

DESIGN BROWSER

Set Active Design

Active	Design	Type
✓	mamdanitype1	Mamdani Type-1

SYSTEM BROWSER

- mamdanitype1
  - Inputs
  - Outputs
  - Rules

System: mamdanitype1

Diagram: Input1 (3 MFs), Input2 (3 MFs) → Mamdani Type 1 → output1 (3 MFs)

System mamdanitype1: 2 input, 1 output, 9 rules

PROPERTY EDITOR: FIS

Type: Mamdani Type-1

Name: mamdanitype1

And method: min

Or method: max

Implication method: min

Aggregation method: max

Defuzzification method: centroid

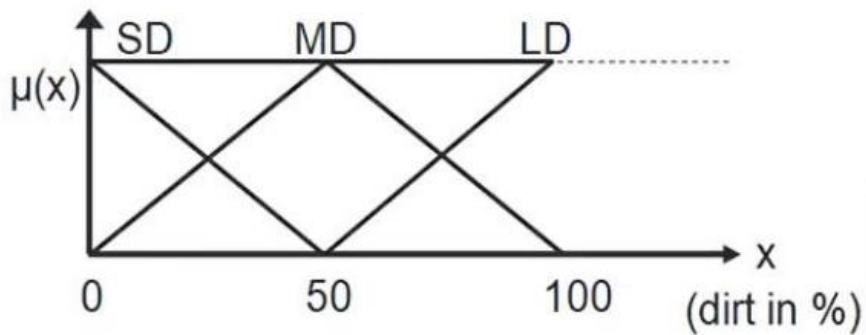
Inputs: 2

Outputs: 1

Rules: 9

Double Click on input1 and set descriptors for input Dirt as SD, MD, LD as per the graph.

(1) Membership function for dirt:



System: mamdanitype1

Membership Function (MF) Editor

PROPERTY EDITOR: INPUT

Name: dirt

Range: [0 100]

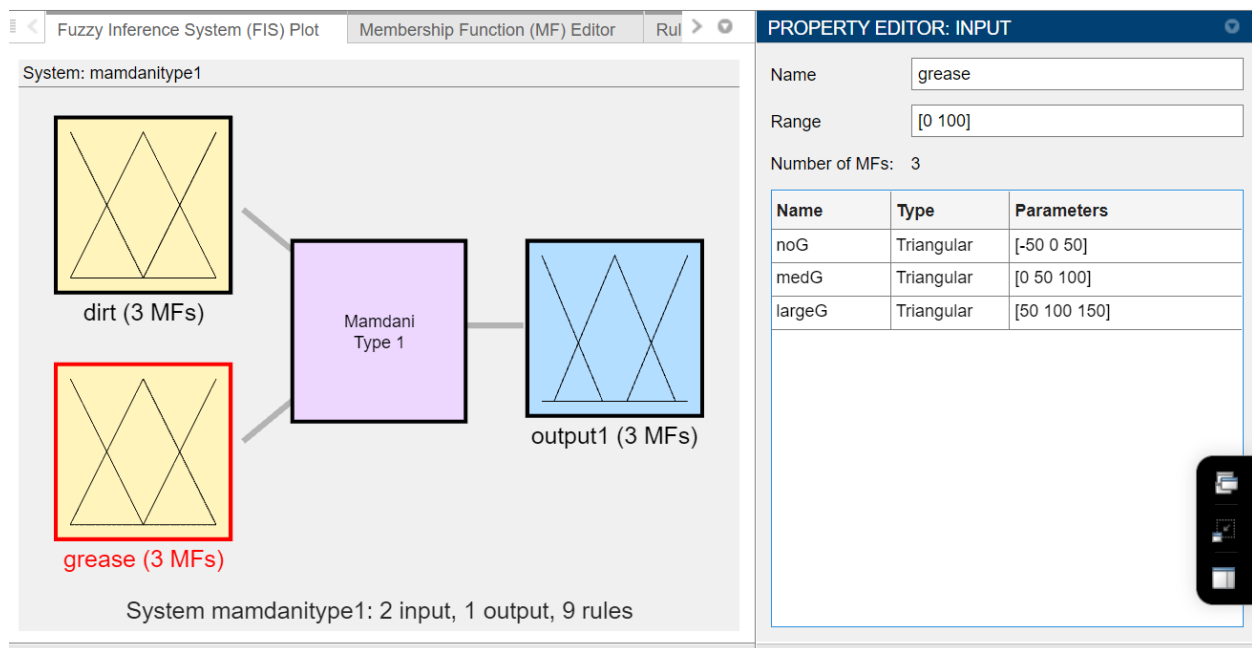
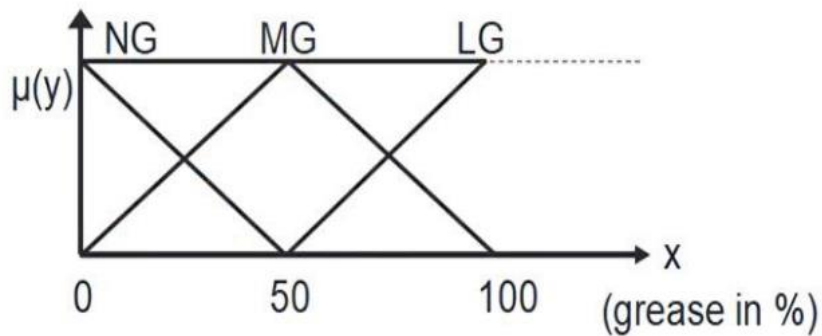
Number of MFs: 3

Name	Type	Parameters
smallD	Triangular	[-50 0 50]
medD	Triangular	[0 50 100]
largeD	Triangular	[50 100 150]

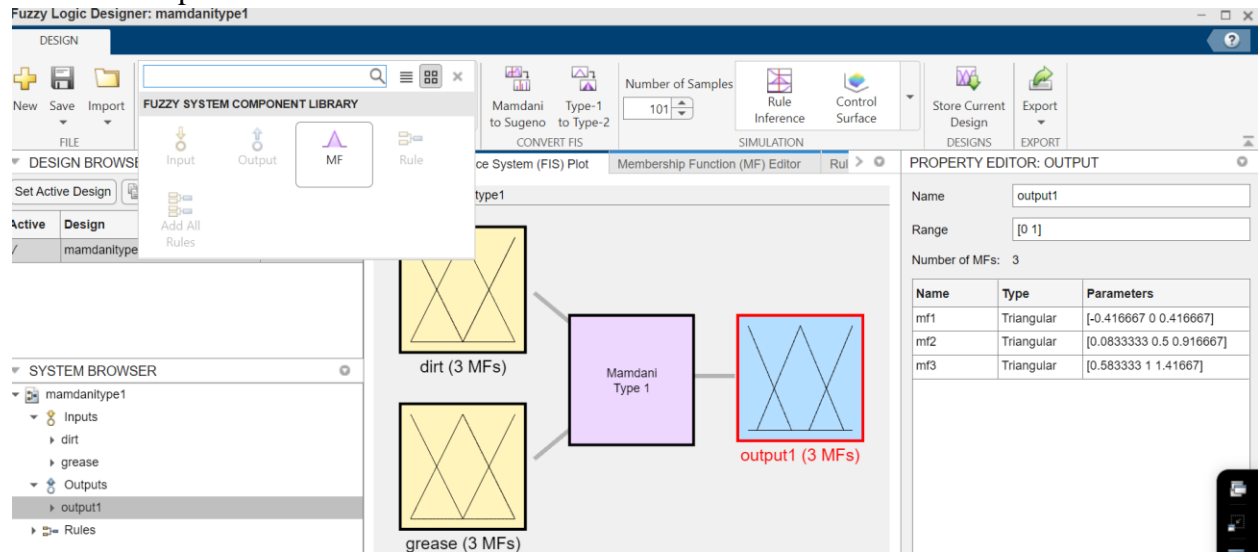
System mamdanitype1: 2 input, 1 output, 9 rules

Do the same for input2 with grease descriptors and membership functions.

## (2) Membership function for grease:

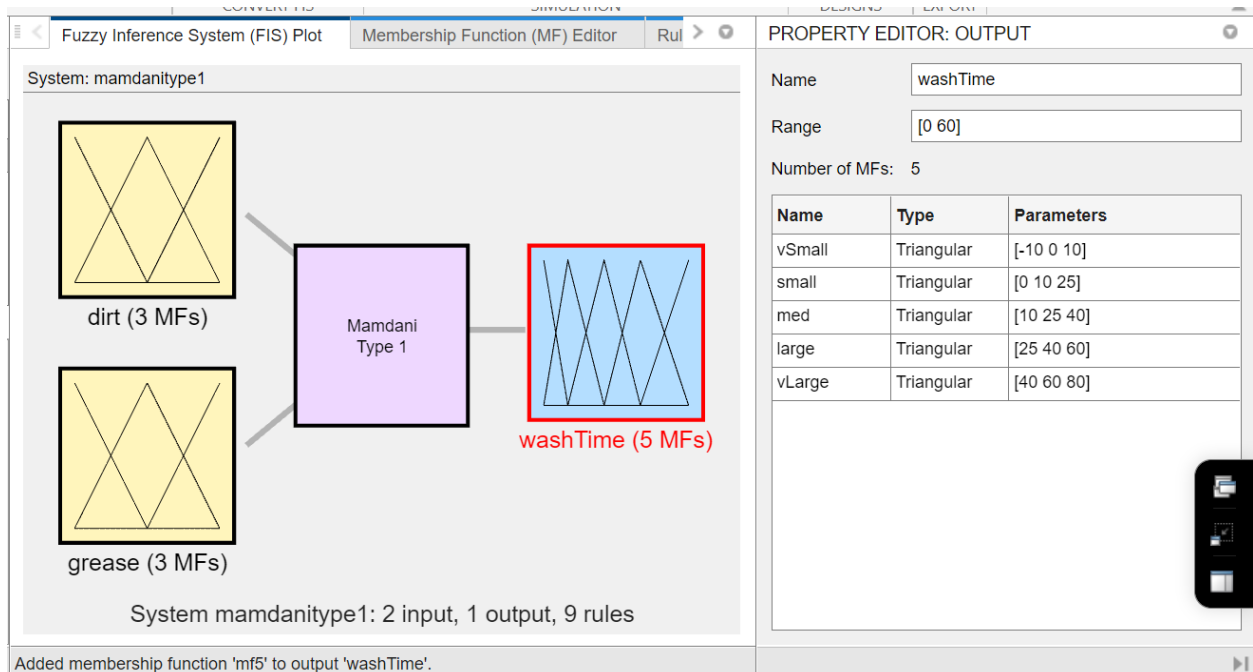
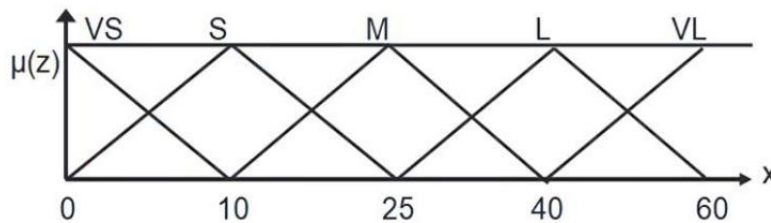


Edit the output for wash time. Here add 2 more membership functions. Click twice on MF to add 2 membership functions.



Edit Range and MF values according to the graph.

(3) **Membership function for Wash time:**



Click on Mamdani Type 1 box.

Fuzzy Inference System (FIS) Plot   Membership Function (MF) Editor   Rule Editor

System: mamdanitype1

PROPERTY EDITOR: RULES

Number of rules: 9   View in Rule Editor

Rule	Rule
1	If (dirt is smallD) and (grease is noG) then (washTi
2	If (dirt is medD) and (grease is noG) then (washTi
3	If (dirt is largeD) and (grease is noG) then (washTi
4	If (dirt is smallD) and (grease is medG) then (wash
5	If (dirt is medD) and (grease is medG) then (washT
6	If (dirt is largeD) and (grease is medG) then (wash
7	If (dirt is smallD) and (grease is largeG) then (wash

Preview

Name:

Weight:

Description:

Click on View in Rule Editor.

Fuzzy Inference System (FIS) Plot   Membership Function (MF) Editor   Rule Editor

System: mamdanitype1

Add All Possible Rules   Clear All Rules

Rule	Weight	Name
1 If dirt is smallD and grease is noG then washTime is vSmall	1	rule1
2 If dirt is medD and grease is noG then washTime is vSmall	1	rule2
3 If dirt is largeD and grease is noG then washTime is vSmall	1	rule3
4 If dirt is smallD and grease is medG then washTime is vSmall	1	rule4
5 If dirt is medD and grease is medG then washTime is vSmall	1	rule5
6 If dirt is largeD and grease is medG then washTime is vSmall	1	rule6
7 If dirt is smallD and grease is largeG then washTime is vSmall	1	rule7
8 If dirt is medD and grease is largeG then washTime is vSmall	1	rule8
9 If dirt is largeD and grease is largeG then washTime is vSmall	1	rule9

PROPERTY EDITOR: RULE

Name: rule1

Weight: 1

Connection: ☒ And   ☐ Or

If

dirt is smallD and

grease is noG

Then

washTime is vSmall

Now edit the rules according to the following matrix.

$x \backslash y$	NG	MG	LG
SD	VS	M	L
MD	S	M	L
LD	M	L	VL

Fuzzy Inference System (FIS) Plot    Membership Function (MF) Editor    Rule Editor

System: mamdanitype1

Add All Possible Rules    Clear All Rules

	Rule	Weight	Name
1	If dirt is smallD and grease is noG then washTime is vSmall	1	rule1
2	If dirt is medD and grease is noG then washTime is small	1	rule2
3	If dirt is largeD and grease is noG then washTime is med	1	rule3
4	If dirt is smallD and grease is medG then washTime is med	1	rule4
5	If dirt is medD and grease is medG then washTime is med	1	rule5
6	If dirt is largeD and grease is medG then washTime is large	1	rule6
7	If dirt is smallD and grease is largeG then washTime is large	1	rule7
8	If dirt is medD and grease is largeG then washTime is large	1	rule8
9	If dirt is largeD and grease is largeG then washTime is vLarge	1	rule9

**PROPERTY EDITOR: RULE**

Name: rule9

Weight: 1

Connection: ☒ And    ☐ Or

**If**

dirt is largeD and grease is largeG

**Then**

washTime is vLarge

Now the fuzzy logic system has been set up. You may check the input output test cases by clicking on Rule Inference in the SIMULATION section in the Navigation Ribbon at the top.

DESIGN

New Save Import

Input Output MF Rule

Mamdani to Sugeno Type-1 to Type-2

Number of Samples: 101

Rule Inference Control Surface

Store Current Design Export

DESIGNS EXPORT

DESIGN BROWSER    Fuzzy Inference System (FIS) Plot    Membership Function (MF) Editor    Rule Editor    PROPERTY EDITOR: RULE



Enter input as [60 70] and hit Enter. The output is generated.

