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Class: BE IT B

Roll No: 1

In [ ]:

```
from skfuzzy import control as ctrl
import skfuzzy as fuzz
import numpy as np
import matplotlib.pyplot as plt
```

In [ ]:

```
# Washing Machine Fuzzy System
class WashingMachine:
    # Antecedents
    level_dirt = ctrl.Antecedent(np.arange(0, 101, 1), 'level_dirt')
    grease = ctrl.Antecedent(np.arange(0, 101, 1), 'grease')

    # Consequent
    wash_time = ctrl.Consequent(np.arange(0, 61, 1), 'wash_time')

    # Membership functions for dirt
    dirt_levels = ['Low', 'Medium', 'High']
    level_dirt.automf(names=dirt_levels)

    # Membership functions for grease
    grease_levels = ['LowG', 'MediumG', 'HighG']
    grease.automf(names=grease_levels)

    # Membership functions for wash time
    wash_time['very_short'] = fuzz.trimf(wash_time.universe, [0, 8, 12])
    wash_time['short'] = fuzz.trimf(wash_time.universe, [8, 12, 20])
    wash_time['medium'] = fuzz.trimf(wash_time.universe, [12, 20, 40])
    wash_time['long'] = fuzz.trimf(wash_time.universe, [20, 40, 60])
    wash_time['very_long'] = fuzz.trimf(wash_time.universe, [40, 60, 60])

    # Rules
    rule1 = ctrl.Rule(level_dirt['High'] | grease['HighG'], wash_time['very_long'])
    rule2 = ctrl.Rule(level_dirt['Medium'] | grease['HighG'], wash_time['long'])
    rule3 = ctrl.Rule(level_dirt['Low'] | grease['HighG'], wash_time['long'])
    rule4 = ctrl.Rule(level_dirt['High'] | grease['MediumG'], wash_time['long'])
    rule5 = ctrl.Rule(level_dirt['Medium'] | grease['MediumG'], wash_time['medium'])
    rule6 = ctrl.Rule(level_dirt['Low'] | grease['MediumG'], wash_time['medium'])
    rule7 = ctrl.Rule(level_dirt['High'] | grease['LowG'], wash_time['medium'])
    rule8 = ctrl.Rule(level_dirt['Medium'] | grease['LowG'], wash_time['short'])
    rule9 = ctrl.Rule(level_dirt['Low'] | grease['LowG'], wash_time['very_short'])

    # Control System
    washing_ctrl = ctrl.ControlSystem([rule1, rule2, rule3, rule4, rule5, rule6, rule7, rule8, rule9])
    washing = ctrl.ControlSystemSimulation(washing_ctrl)

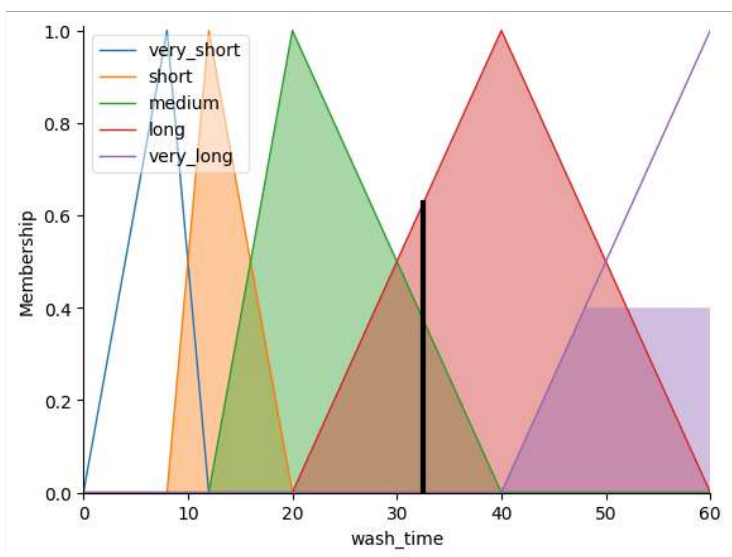
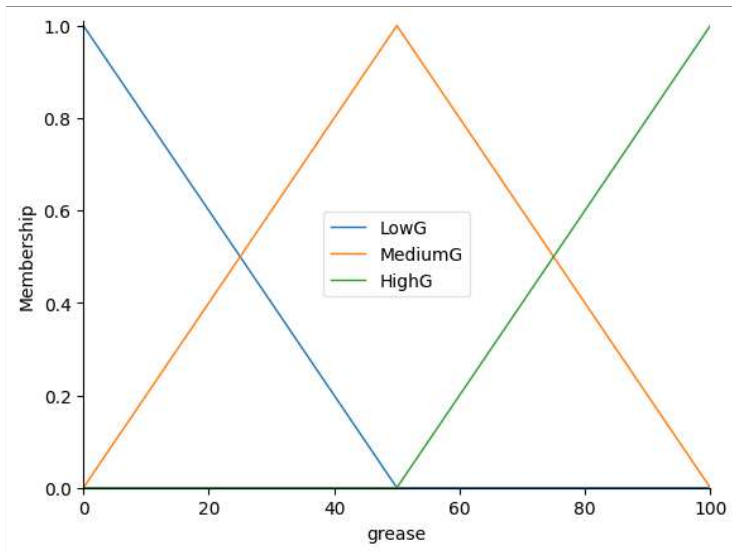
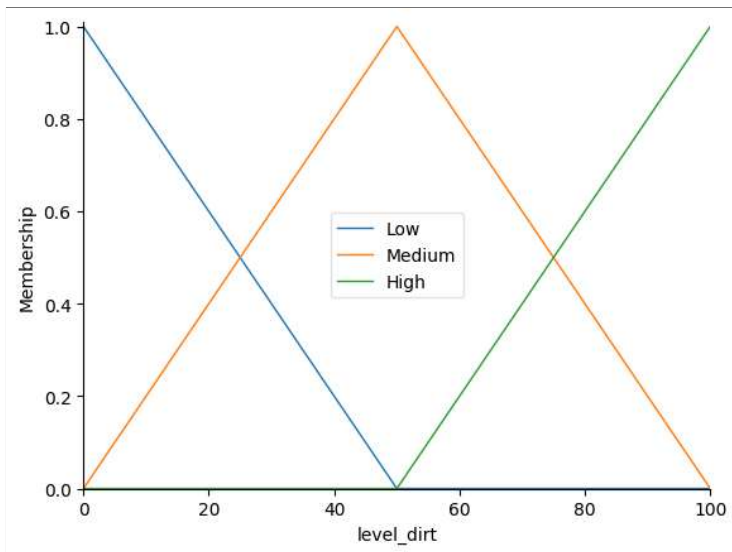
# Function to run fuzzy Logic
def fuzzify_laundry(fuzz_type, fuzz_degree):
    WashingMachine.washing.input['grease'] = fuzz_type
    WashingMachine.washing.input['level_dirt'] = fuzz_degree
    WashingMachine.washing.compute()

    WashingMachine.level_dirt.view()
    WashingMachine.grease.view()
    WashingMachine.wash_time.view(sim=WashingMachine.washing)

    plt.show()

    return WashingMachine.washing.output['wash_time']
```

```
result = fuzzify_laundry(fuzz_type=70, fuzz_degree=50)
print("Predicted Wash Time:", result)
```



Predicted Wash Time: 32.53564547206166

In [ ]:

```

def compute_washing_parameters(level_of_dirt, level_of_grease):
    if level_of_dirt < 0.0 or level_of_dirt > 100.0:
        raise Exception("Invalid Level of Dirtiness: %f" % level_of_dirt)

    if level_of_grease < 0.0 or level_of_grease > 100.0:
        raise Exception("Invalid Level of Grease: %f" % level_of_grease)

    type_fuzzy = fuzzify_laundry(level_of_dirt, level_of_grease)

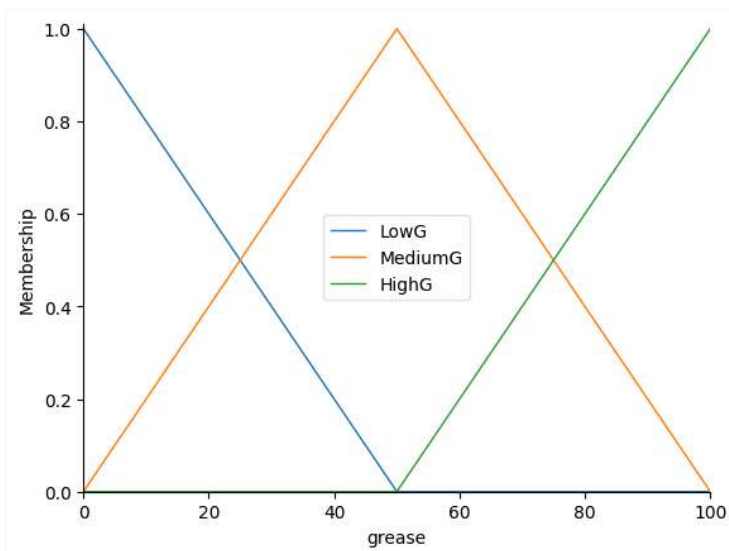
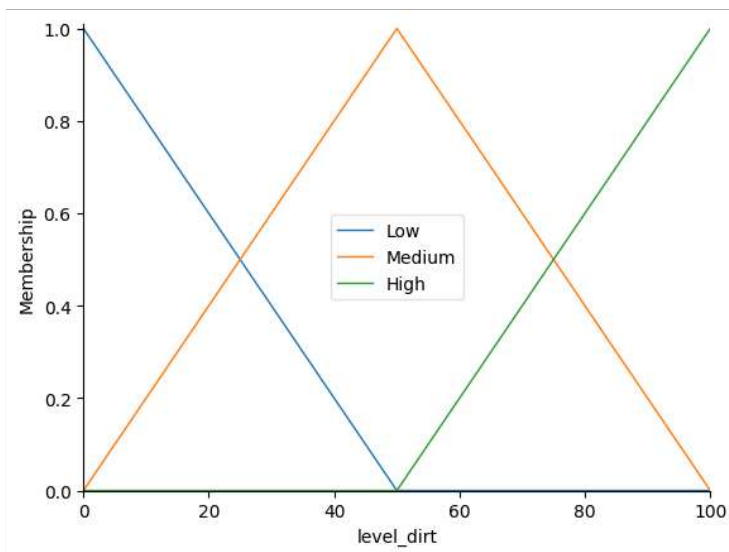
    return type_fuzzy

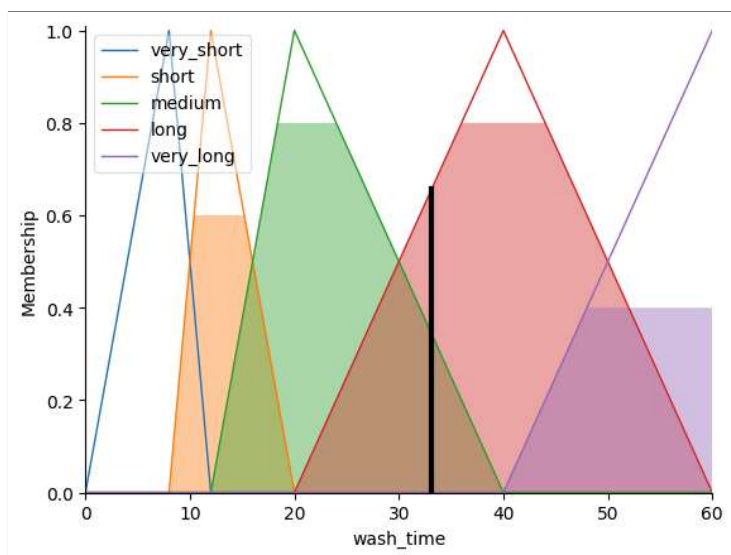
if __name__ == "__main__":
    level_of_dirt = float(input("Enter Level of Dirtiness [0-100]: "))
    level_of_grease = float(input("Enter Level of Grease [0-100]: "))

    washing_parameters = compute_washing_parameters(level_of_dirt, level_of_grease)
    print("Washing Parameters:", washing_parameters)

```

Enter Level of Dirtiness [0-100]: 60  
Enter Level of Grease [0-100]: 70





Washing Parameters: 33.14911193721603