In [ ]:
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Practical No. 03 - Implement Union, Intersection, Complement and Difference operations o
create fuzzy relations by Cartesian product of any two fuzzy sets and perform max-min
composition on any two fuzzy relations.
```

In [1]:
```
import numpy as np
```

In [2]:
```
# Function to perform Union operation on fuzzy sets
def fuzzy_union(A, B):
    return np.maximum(A, B)
```

In [3]:
```
# Function to perform Intersection operation on fuzzy sets
def fuzzy_intersection(A, B):
    return np.minimum(A, B)
```

In [4]:
```
# Function to perform Complement operation on a fuzzy set
def fuzzy_complement(A):
    return 1 - A
```

In [5]:
```
# Function to perform Difference operation on fuzzy sets
def fuzzy_difference(A, B):
    return np.maximum(A, 1 - B)
```

In [6]:
```
# Function to create fuzzy relation by Cartesian product of two fuzzy sets
def cartesian_product(A, B):
    return np.outer(A, B)
```

In [7]:
```
# Function to perform Max-Min composition on two fuzzy relations
def max_min_composition(R, S):
    return np.max(np.minimum.outer(R, S), axis=1)
```

In [11]:
```
# Example usage
A = np.array([0.2, 0.4, 0.6, 0.8])  # Fuzzy set A
B = np.array([0.3, 0.5, 0.7, 0.9])  # Fuzzy set B
```

In [12]:
```
# Operations on fuzzy sets
union_result = fuzzy_union(A, B)
intersection_result = fuzzy_intersection(A, B)
complement_A = fuzzy_complement(A)
difference_result = fuzzy_difference(A, B)
```

In [13]:
```
print("Union:", union_result)
print("Intersection:", intersection_result)
print("Complement of A:", complement_A)
print("Difference:", difference_result)
```

```
Union: [0.3 0.5 0.7 0.9]
Intersection: [0.2 0.4 0.6 0.8]
Complement of A: [0.8 0.6 0.4 0.2]
Difference: [0.7 0.5 0.6 0.8]
```

In [14]:
```
# Fuzzy relations
R = np.array([0.2, 0.5, 0.4])  # Fuzzy relation R
```

```
S = np.array([0.6, 0.3, 0.7])  # Fuzzy relation S
```

In [15]:
```
# Cartesian product of fuzzy relations
cartesian_result = cartesian_product(R, S)
```

In [16]:
```
# Max-Min composition of fuzzy relations
composition_result = max_min_composition(R, S)
```

In [17]:
```
print("Cartesian product of R and S:")
print(cartesian_result)
```

```
Cartesian product of R and S:
[[0.12 0.06 0.14]
 [0.3  0.15 0.35]
 [0.24 0.12 0.28]]
```

In [18]:
```
print("Max-Min composition of R and S:")
print(composition_result)
```

```
Max-Min composition of R and S:
[0.2 0.5 0.4]
```

In [ ]: