***ТПР***

***Вариант 10***

***Задача № 1***

Заданы нечеткие множества А и В с функциями принадлежности и :

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Х | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|  | 0.2 | 0.5 | 0 | 0.4 | 0.3 | 0.3 | 0.1 | 0.9 | 0.9 | 0 | 0.5 | 0.9 |
|  | 0.6 | 0.5 | 0.3 | 0.6 | 0.8 | 0.2 | 0.9 | 0.3 | 0.4 | 0.6 | 0.8 | 0.1 |

Построить функции принадлежности для следующих нечётких множеств:

а) АВ; б) АВ в)  г) д) А\В е) АВ

ё) АВ ж)

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Х | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|  | 0.2 | 0.5 | 0 | 0.4 | 0.3 | 0.3 | 0.1 | 0.9 | 0.9 | 0 | 0.5 | 0.9 |
|  | 0.6 | 0.5 | 0.3 | 0.6 | 0.8 | 0.2 | 0.9 | 0.3 | 0.4 | 0.6 | 0.8 | 0.1 |
|  | 0.6 | 0.5 | 0.3 | 0.6 | 0.8 | 0.3 | 0.9 | 0.9 | 0.9 | 0.6 | 0.8 | 0.9 |
|  | 0.2 | 0.5 | 0 | 0.4 | 0.3 | 0.2 | 0.1 | 0.3 | 0.4 | 0 | 0.5 | 0.1 |
|  | 0.8 | 0.5 | 1 | 0.6 | 0.7 | 0.7 | 0.9 | 0.1 | 0.1 | 1 | 0.5 | 0.1 |
|  | 0.4 | 0.5 | 0.7 | 0.4 | 0.2 | 0.8 | 0.1 | 0.7 | 0.6 | 0.4 | 0.2 | 0.9 |
|  | 0 | 0 | 0 | 0 | 0 | 0.1 | 0 | 0.6 | 0.5 | 0 | 0 | 0.8 |
|  | 0.8 | 1 | 0.3 | 1 | 1 | 0.5 | 1 | 1 | 1 | 0.6 | 1 | 1 |
|  | 0.12 | 0.25 | 0 | 0.24 | 0.06 | 0.06 | 0.09 | 0.27 | 0.36 | 0 | 0.4 | 0.09 |
|  | 0.48 | 0.25 | 0.3 | 0.36 | 0.56 | 0.14 | 0.81 | 0.03 | 0.04 | 0.6 | 0.4 | 0.01 |
|  | 0.4 | 0.5 | 0.7 | 0.4 | 0.3 | 0.8 | 0.1 | 0.9 | 0.9 | 0.4 | 0.5 | 0.9 |
|  | 0.08 | 0 | 0 | 0 | 0.26 | 0 | 0.71 | 0 | 0 | 0.2 | 0 | 0 |

***Задача № 2***

Заданы нечеткие множества А и В с функциями принадлежности и :

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| х | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|  | 0.7 | 0.9 | 0.8 | 0.6 | 0.1 | 0.3 | 0.4 | 0.2 | 0.5 | 0.3 |
|  | 0.6 | 0.4 | 0.5 | 0.2 | 0 | 0.7 | 0 | 0 | 0.3 | 0.8 |

а) построить подмножества уровня α Аα и Вα , где α=0.5; 0.7; 0,8

б) построить (АВ)α и (АВ)α и убедиться, что

 и , где α=0,4

***а)***А0.5={1,2,3,4,9}А0.7={1,2,3}

А0.8={2,3}

B0.5={1,3,6,10}

B0.7={6,10}

B0.8={10}

***б)α=0.4***

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| х | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|  | 0.7 | 0.9 | 0.8 | 0.6 | 0.1 | 0.3 | 0.4 | 0.2 | 0.5 | 0.3 |
|  | 0.6 | 0.4 | 0.5 | 0.2 | 0 | 0.7 | 0 | 0 | 0.3 | 0.8 |
|  | 0.7 | 0.9 | 0.8 | 0.6 | 0.1 | 0.7 | 0.4 | 0.2 | 0.5 | 0.8 |
|  | 0.6 | 0.4 | 0.5 | 0.2 | 0 | 0.3 | 0 | 0 | 0.3 | 0.3 |

А0.4={1,2,3,4,7,9}

B0.4={1,2,3,6,10}





***Задача № 3***

Заданы нечеткие множества А , В и С с соответствующими функциями принадлежности, заданными в табличном виде:

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| х | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|  | 0.4 | 0.9 | 0.4 | 0.9 | 0.8 | 0 | 0.9 | 0.8 | 0.4 | 0.6 |
|  | 0.4 | 0 | 0.8 | 0.8 | 0.4 | 0.2 | 0 | 0 | 0.8 | 0.3 |
|  | 0 | 0 | 0.8 | 0.1 | 0.2 | 0.9 | 0 | 0.5 | 0.8 | 0.7 |

а) найти функцию принадлежности выпуклой комбинации этих множеств с весами:

=0,2; =0,3; =0,5

, если 

в противном случае.

б) построить  и , где α=0,2 и убедиться, что

 и 

a)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| х | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|  | 0.4 | 0.9 | 0.4 | 0.9 | 0.8 | 0 | 0.9 | 0.8 | 0.4 | 0.6 |
|  | 0.4 | 0 | 0.8 | 0.8 | 0.4 | 0.2 | 0 | 0 | 0.8 | 0.3 |
|  | 0 | 0 | 0.8 | 0.1 | 0.2 | 0.9 | 0 | 0.5 | 0.8 | 0.7 |
|  | 0.2 | 0.18 | 0.72 | 0.47 | 0.38 | 0.51 | 0.18 | 0.41 | 0.72 | 0.56 |

б)α=0,2

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| х | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|  | 0.8 | 0.9 | 1 | 1 | 1 | 1 | 0.9 | 1 | 1 | 1 |
|  | 0 | 0 | 0.256 | 0.072 | 0.064 | 0 | 0 | 0 | 0.256 | 0.126 |

={1,2,3,4,5,6,7,8,9,10}

={1,2,3,4,5,7,8,9,10}

={1,3,4,5,6,9,10}

={3,5,6,8,9,10}



={3,5,9,10}

={3,9}



***Задача № 4***

Доказать, что для нечетких множеств А , В и С с функциями принадлежности ,  и  выполняется следующее:

а) ;

б), где 

a)







б)



***Задача № 5***

Проверить, является ли нечеткое отношение R, заданное функцией принадлежности , симметричным и рефлексивным:

,.



Оскільки, то, тому відношення не є симетричним.

, тому відношення не рефлексивне.

***Задача № 6***

Проверить, является ли транзитивным нечеткое отношение R, заданное функцией принадлежности , вида:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | X1 | X2 | X3 | X4 |
| X1 | 0.2 | 0.7 | 0.3 | 0.1 |
| X2 | 0.6 | 0.8 | 0 | 0.9 |
| X3 | 0.5 | 0.7 | 0.4 | 0.7 |
| X4 | 0.6 | 0.9 | 0.4 | 0.1 |

Спершу знаходимо композицію Rна R:

|  |  |  |
| --- | --- | --- |
| Максимінна композиція | Мінімаксна композиція | Мультиплікативна композиція |
| |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | X1 | X2 | X3 | X4 | | X1 | 0.6 | 0.7 | 0.3 | 0.7 | | X2 | 0.6 | 0.9 | 0.4 | 0.8 | | X3 | 0.6 | 0.7 | 0.4 | 0.7 | | X4 | 0.6 | 0.8 | 0.4 | 0.9 |       Звідси відношення не є транзитивним у сенсі максимінної транзитивності. | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | X1 | X2 | X3 | X4 | | X1 | 0.2 | 0.7 | 0.3 | 0.1 | | X2 | 0.5 | 0.7 | 0.4 | 0.6 | | X3 | 0.5 | 0.7 | 0.4 | 0.5 | | X4 | 0.5 | 0.7 | 0.4 | 0.1 |     Звідси відношення не є транзитивним у сенсі мінімаксної транзитивності. | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | X1 | X2 | X3 | X4 | | X1 | 0.04 | 0.09 | 0 | 0.01 | | X2 | 0 | 0 | 0 | 0 | | X3 | 0.1 | 0.28 | 0 | 0.05 | | X4 | 0.06 | 0.09 | 0 | 0.01 |     Звідси відношення є транзитивним у сенсі мультиплікативної транзитивності. |

***Задача № 7***

Для нечётких отношений А и В, функции принадлежности которых имеют вид:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | А | Х1 | Х2 | Х3 | Х4 | Х5 | | Х1 | 0.2 | 0.3 | 0.3 | 0.7 | 0.9 | | Х2 | 0.4 | 0 | 0.5 | 0.4 | 0.4 | | Х3 | 0.1 | 0 | 0.8 | 0 | 0.4 | | Х4 | 0.4 | 0.8 | 0.1 | 0.3 | 0.6 | | Х5 | 0.1 | 0.4 | 0.4 | 0.3 | 0.2 | | |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | В | Х1 | Х2 | Х3 | Х4 | Х5 | | Х1 | 0.4 | 0.7 | 0.7 | 0.9 | 0.3 | | Х2 | 0.7 | 0 | 0.4 | 0.8 | 0.9 | | Х3 | 0.4 | 0 | 0.7 | 0.1 | 0.6 | | Х4 | 0.4 | 0.7 | 0.4 | 0.3 | 0.6 | | Х5 | 0.1 | 0.6 | 0.7 | 0.2 | 0.1 | |

Построить следующее:

а) АВ; б) АВ в)  г) д) А\В е) 

ё)  ж) 

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | АВ | Х1 | Х2 | Х3 | Х4 | Х5 | | Х1 | 0.4 | 0.7 | 0.7 | 0.9 | 0.9 | | Х2 | 0.7 | 0 | 0.5 | 0.8 | 0.9 | | Х3 | 0.4 | 0 | 0.8 | 0.1 | 0.6 | | Х4 | 0.4 | 0.8 | 0.4 | 0.3 | 0.6 | | Х5 | 0.1 | 0.6 | 0.7 | 0.3 | 0.2 | | |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | АВ | Х1 | Х2 | Х3 | Х4 | Х5 | | Х1 | 0.2 | 0.3 | 0.3 | 0.7 | 0.3 | | Х2 | 0.4 | 0 | 0.4 | 0.4 | 0.4 | | Х3 | 0.1 | 0 | 0.7 | 0 | 0.4 | | Х4 | 0.4 | 0.7 | 0.1 | 0.3 | 0.6 | | Х5 | 0.1 | 0.4 | 0.4 | 0.2 | 0.1 | |
| |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | |  | Х1 | Х2 | Х3 | Х4 | Х5 | | Х1 | 0.8 | 0.7 | 0.7 | 0.3 | 0.1 | | Х2 | 0.6 | 1 | 0.5 | 0.6 | 0.6 | | Х3 | 0.9 | 1 | 0.2 | 1 | 0.6 | | Х4 | 0.6 | 0.2 | 0.9 | 0.7 | 0.4 | | Х5 | 0.9 | 0.6 | 0.6 | 0.7 | 0.8 | | |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | |  | Х1 | Х2 | Х3 | Х4 | Х5 | | Х1 | 0.6 | 0.3 | 0.3 | 0.1 | 0.7 | | Х2 | 0.3 | 1 | 0.6 | 0.2 | 0.1 | | Х3 | 0.6 | 1 | 0.3 | 0.9 | 0.4 | | Х4 | 0.6 | 0.3 | 0.6 | 0.7 | 0.4 | | Х5 | 0.9 | 0.4 | 0.3 | 0.8 | 0.9 | |
| |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | А\B | Х1 | Х2 | Х3 | Х4 | Х5 | | Х1 | 0 | 0 | 0 | 0 | 0.6 | | Х2 | 0 | 0 | 0.1 | 0 | 0 | | Х3 | 0 | 0 | 0.1 | 0 | 0 | | Х4 | 0 | 0.1 | 0 | 0 | 0 | | Х5 | 0 | 0 | 0 | 0.1 | 0.1 | |  |
| |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | |  | Х1 | Х2 | Х3 | Х4 | Х5 | | Х1 | 0.2 | 0.4 | 0.1 | 0.4 | 0.1 | | Х2 | 0.3 | 0 | 0 | 0.8 | 0.4 | | Х3 | 0.3 | 0.5 | 0.8 | 0.1 | 0.4 | | Х4 | 0.7 | 0.4 | 0 | 0.3 | 0.3 | | Х5 | 0.9 | 0.4 | 0.4 | 0.6 | 0.2 | | |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | |  | Х1 | Х2 | Х3 | Х4 | Х5 | | Х1 | 0.4 | 0.7 | 0.4 | 0.4 | 0.1 | | Х2 | 0.7 | 0 | 0 | 0.7 | 0.6 | | Х3 | 0.7 | 0.4 | 0.7 | 0.4 | 0.7 | | Х4 | 0.9 | 0.8 | 0.1 | 0.3 | 0.2 | | Х5 | 0.3 | 0.9 | 0.6 | 0.6 | 0.1 | |
| |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | |  | Х1 | Х2 | Х3 | Х4 | Х5 | | Х1 | 0.2 | 0.3 | 0.3 | 0.1 | 0.7 | | Х2 | 0.3 | 0 | 0.5 | 0.2 | 0.1 | | Х3 | 0.1 | 0 | 0.3 | 0 | 0.4 | | Х4 | 0.4 | 0.3 | 0.1 | 0.3 | 0.4 | | Х5 | 0.1 | 0.4 | 0.3 | 0.3 | 0.2 | | |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | |  | Х1 | Х2 | Х3 | Х4 | Х5 | | Х1 | 0.4 | 0.7 | 0.7 | 0.3 | 0.1 | | Х2 | 0.6 | 0 | 0.4 | 0.6 | 0.6 | | Х3 | 0.4 | 0 | 0.2 | 0.1 | 0.6 | | Х4 | 0.4 | 0.2 | 0.4 | 0.3 | 0.4 | | Х5 | 0.1 | 0.6 | 0.6 | 0.2 | 0.1 | |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Х1 | Х2 | Х3 | Х4 | Х5 |
| Х1 | 0.4 | 0.7 | 0.7 | 0.3 | 0.7 |
| Х2 | 0.6 | 0 | 0.5 | 0.6 | 0.6 |
| Х3 | 0.4 | 0 | 0.3 | 0.1 | 0.6 |
| Х4 | 0.4 | 0.3 | 0.4 | 0.3 | 0.4 |
| Х5 | 0.1 | 0.6 | 0.6 | 0.3 | 0.2 |

***Задача № 8***

Для нечётких отношений А и В, с функции принадлежности которых имеют вид:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | А | Y1 | Y2 | Y3 | Y4 | Y5 | | X1 | 0.4 | 0.2 | 0.6 | 0.1 | 0.6 | | X2 | 0.9 | 0.1 | 0.8 | 0.4 | 0.4 | | X3 | 0.5 | 0 | 0.4 | 0.8 | 0.5 | | |  |  |  |  |  | | --- | --- | --- | --- | --- | | B | Z1 | Z2 | Z3 | Z4 | | Y1 | 0.9 | 0.9 | 0.9 | 0.2 | | Y2 | 0.9 | 0.9 | 0.4 | 0.8 | | Y3 | 0.1 | 0.6 | 0.7 | 0 | | Y4 | 0.2 | 0.4 | 0.5 | 0.5 | | Y5 | 0.1 | 0.2 | 0.4 | 0.1 | |

Построить , , , где соответственно:

;

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | |  | X1 | X2 | X3 | X4 | X5 | | X1 | 0.5 | 0.2 | 0.4 | 0.6 | 0.5 | | X2 | 0.5 | 0.2 | 0.6 | 0.8 | 0.6 | | X3 | 0.4 | 0.2 | 0.5 | 0.4 | 0.5 | | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | X1 | X2 | X3 | X4 | | X1 | 0.9 | 0.9 | 0.9 | 0.8 | | X2 | 0.9 | 0.9 | 0.9 | 0.8 | | X3 | 0.6 | 0.6 | 0.7 | 0.6 | | X4 | 0.4 | 0.5 | 0.5 | 0.5 | | X5 | 0.2 | 0.4 | 0.4 | 0.2 | |

;

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | |  | X1 | X2 | X3 | X4 | X5 | | X1 | 0.4 | 0.2 | 0.6 | 0.4 | 0.4 | | X2 | 0.8 | 0.1 | 0.8 | 0.4 | 0.4 | | X3 | 0.5 | 0.1 | 0.4 | 0.4 | 0.4 | | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | X1 | X2 | X3 | X4 | | X1 | 0.2 | 0.4 | 0.5 | 0.5 | | X2 | 0.4 | 0.6 | 0.7 | 0.4 | | X3 | 0.2 | 0.4 | 0.5 | 0.2 | | X4 | 0.5 | 0.5 | 0.4 | 0.2 | | X5 | 0.2 | 0.4 | 0.4 | 0.2 | |



|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | |  | X1 | X2 | X3 | X4 | X5 | | X1 | 0.16 | 0 | 0.16 | 0.04 | 0.08 | | X2 | 0.09 | 0 | 0.08 | 0.04 | 0.04 | | X3 | 0 | 0 | 0 | 0 | 0 | | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | X1 | X2 | X3 | X4 | | X1 | 0.04 | 0.08 | 0.1 | 0 | | X2 | 0.04 | 0.24 | 0.28 | 0 | | X3 | 0 | 0 | 0 | 0 | | X4 | 0.05 | 0.18 | 0.16 | 0 | | X5 | 0.02 | 0.04 | 0.05 | 0 | |

***Задача № 9***

Задано нечеткое отношение R с функцией принадлежности вида:

|  |  |  |  |
| --- | --- | --- | --- |
|  | X1 | X2 | X3 |
| X1 | 0.1 | 0 | 0.2 |
| X2 | 0.1 | 0.1 | 0.6 |
| X3 | 0.7 | 0.2 | 0.7 |

Построить , , , и проверить, выполняется ли 

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  |  | | --- | --- | --- | --- | |  | X1 | X2 | X3 | | X1 | 0.2 | 0.2 | 0.2 | | X2 | 0.6 | 0.2 | 0.6 | | X3 | 0.7 | 0.2 | 0.7 | | |  |  |  |  | | --- | --- | --- | --- | |  | X1 | X2 | X3 | | X1 | 0.1 | 0.1 | 0.2 | | X2 | 0.1 | 0.1 | 0.2 | | X3 | 0.2 | 0.2 | 0.6 | | |  |  |  |  | | --- | --- | --- | --- | |  | X1 | X2 | X3 | | X1 | 0 | 0 | 0 | | X2 | 0.01 | 0 | 0.02 | | X3 | 0.02 | 0 | 0.12 | |

виконується, бо 

***Задача № 10***

Для следующих нечетких отношений предпочтения, заданных функцией принадлежности в виде таблицы, найти отношение строгого предпочтения, множество недоминируемых альтернатив и наиболее недоминируемую альтернативу:

а)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | X1 | X2 | X3 | X4 | X5 |
| X1 | 1 | 0.8 | 0.4 | 0.9 | 0.2 |
| X2 | 0.9 | 1 | 0.8 | 0.9 | 0.4 |
| X3 | 0.8 | 0.9 | 1 | 0.5 | 0.1 |
| X4 | 0.3 | 0.1 | 0.4 | 1 | 0.6 |
| X5 | 0.3 | 0.4 | 0.2 | 0.6 | 1 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | X1 | X2 | X3 | X4 | X5 |
| X1 | 0 | 0 | 0 | 0.6 | 0 |
| X2 | 0.1 | 0 | 0 | 0.8 | 0 |
| X3 | 0.4 | 0.1 | 0 | 0.1 | 0 |
| X4 | 0 | 0 | 0 | 0 | 0 |
| X5 | 0.1 | 0 | 0.1 | 0 | 0 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | 0.6 | 0.9 | 0.9 | 0.2 | 1 |

б)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | X1 | X2 | X3 | X4 | X5 |
| X1 | 1 | 0.9 | 0.3 | 0.5 | 0.2 |
| X2 | 0.7 | 1 | 0.3 | 0.2 | 0.4 |
| X3 | 0.6 | 0.4 | 1 | 0.6 | 0.4 |
| X4 | 0.5 | 0.2 | 0.9 | 1 | 0.1 |
| X5 | 0.6 | 0.7 | 0.5 | 0.1 | 1 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | X1 | X2 | X3 | X4 | X5 |
| X1 | 0 | 0.2 | 0 | 0 | 0 |
| X2 | 0 | 0 | 0 | 0 | 0 |
| X3 | 0.3 | 0.1 | 0 | 0 | 0 |
| X4 | 0 | 0 | 0.3 | 0 | 0 |
| X5 | 0.4 | 0.3 | 0.1 | 0 | 0 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | 0.6 | 0.7 | 0.7 | 1 | 1 |

в)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | X1 | X2 | X3 | X4 | X5 | X6 |
| X1 | 1 | 0.9 | 0.5 | 0.1 | 0.2 | 0.6 |
| X2 | 0.1 | 1 | 0.9 | 0 | 0.7 | 0.3 |
| X3 | 0.4 | 0.5 | 1 | 0.2 | 0.8 | 0.7 |
| X4 | 0.7 | 0.8 | 0.9 | 1 | 0.8 | 0.6 |
| X5 | 0.2 | 0.7 | 0.2 | 0.2 | 1 | 0.7 |
| X6 | 0.6 | 0.1 | 0.6 | 0.7 | 0.1 | 1 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | X1 | X2 | X3 | X4 | X5 | X6 |
| X1 | 0 | 0.8 | 0.1 | 0 | 0 | 0 |
| X2 | 0 | 0 | 0.4 | 0 | 0 | 0.2 |
| X3 | 0 | 0 | 0 | 0 | 0.6 | 0.1 |
| X4 | 0.6 | 0.8 | 0.7 | 0 | 0.6 | 0 |
| X5 | 0 | 0 | 0 | 0 | 0 | 0.6 |
| X6 | 0 | 0 | 0 | 0.1 | 0 | 0 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | 0.4 | 0.2 | 0.3 | 0.9 | 0.4 | 0.4 |

г)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | X1 | X2 | X3 | X4 | X5 | X6 |
| X1 | 1 | 0.3 | 0.4 | 0.2 | 0.4 | 0.7 |
| X2 | 0.5 | 1 | 0.5 | 0.4 | 0.8 | 0.3 |
| X3 | 0.6 | 0.6 | 1 | 0.5 | 0.6 | 0.9 |
| X4 | 0.7 | 0.3 | 0.4 | 1 | 0.6 | 0.7 |
| X5 | 0.8 | 0.1 | 0.2 | 0.9 | 1 | 0.9 |
| X6 | 0.8 | 0.7 | 0.8 | 0.9 | 0.1 | 1 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | X1 | X2 | X3 | X4 | X5 | X6 |
| X1 | 0 | 0 | 0 | 0 | 0 | 0 |
| X2 | 0.2 | 0 | 0 | 0.1 | 0.7 | 0 |
| X3 | 0.2 | 0.1 | 0 | 0.1 | 0.4 | 0.1 |
| X4 | 0.5 | 0 | 0 | 0 | 0 | 0 |
| X5 | 0.4 | 0 | 0 | 0.3 | 0 | 0.8 |
| X6 | 0.1 | 0.4 | 0 | 0.2 | 0 | 0 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | 0.5 | 0.6 | 1 | 0.7 | 0.3 | 0.2 |