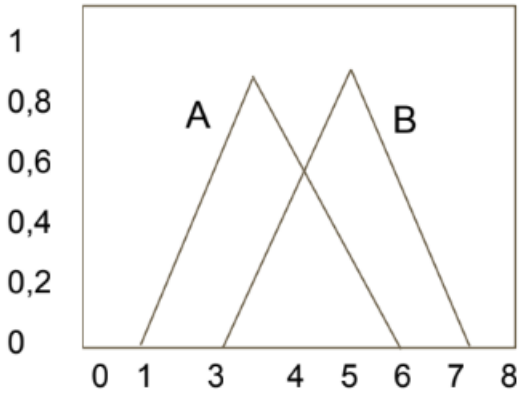
kernel

September 11, 2018

1 Atividade 2 - Operações sobre conjuntos Fuzzy

Programar (em qualquer linguagem) os operadores estudados, aplicá-los sobre os conjuntos fuzzy triangulares abaixo e mostrar o conjunto fuzzy resultante.



1.0.1 Conjuntos A e B

```
In [6]: # import lib
        import matplotlib.pyplot as plt
        %matplotlib inline
```

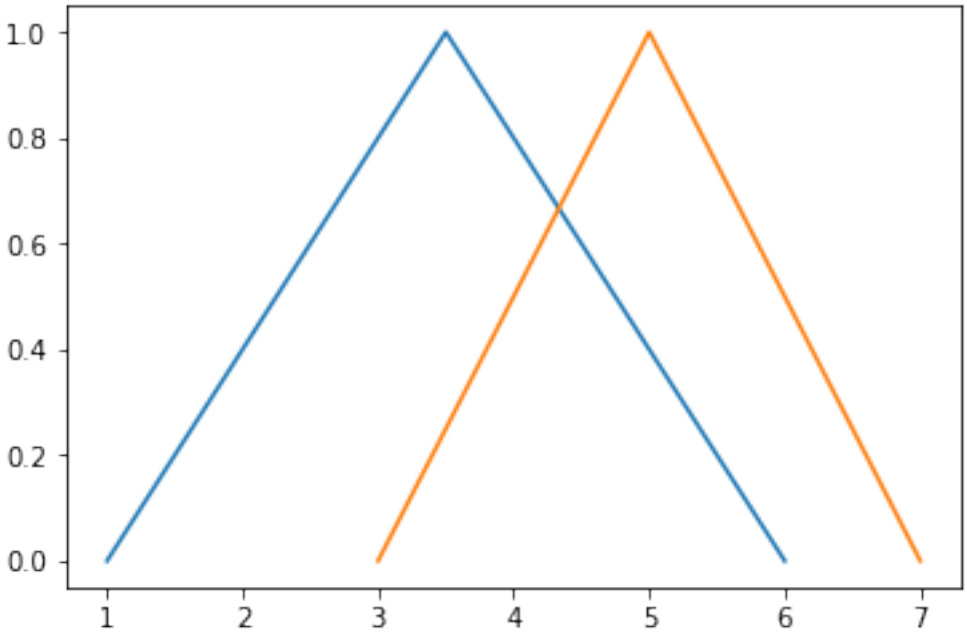
```
In [113]: def get_pertinence_triangle(a,m,b,x, max_degree=None):

              if x <= a or x >= b:
                  return 0

              if x == m and max_degree != None:
                  return max_degree

              if x > a and x <= m:
                  return ((x-a)/(m-a))

              if x > m and x < b:
                  return ((b-x)/(b-m))
```

```
        def get_m(conj):
            return float((conj[0] + conj[len(conj)-1])/2)


        def insert_m(conj, m):
            if m not in conj:
                conj.append(m)
                conj.sort()
            return conj


        A = list(range(1, 6+1))
        B = list(range(3, 7+1))


        cfA = {}
        cfB = {}

        m_A = get_m(A)
        m_B = get_m(B)

        A = insert_m(A, m_A)
        B = insert_m(B, m_B)

        for i in A: # obtendo a pertinência de cada ponto do conjjunto A
            cfA[i] = get_pertinence_triangle(A[0], m_A, A[len(A)-1], i)

        for i in B: # obtendo a pertinência de cada ponto do conjjunto A
            cfB[i] = get_pertinence_triangle(B[0], m_B, B[len(B)-1], i)


        print('Crips A => ', A)
        print('Conjunto B => ', B)

        print(' Fuzzy : elementos e pertinência ', cfA, len(cfA))
        print(' Fuzzy : elementos e pertinência ', cfB, len(cfB))
```

```
Crips A =>  [1, 2, 3, 3.5, 4, 5, 6]
Conjunto B =>  [3, 4, 5, 6, 7]
 Fuzzy : elementos e pertinência  {1: 0, 2: 0.4, 3: 0.8, 3.5: 1.0, 4: 0.8, 5: 0.4, 6: 0} 7
 Fuzzy : elementos e pertinência  {3: 0, 4: 0.5, 5: 1.0, 6: 0.5, 7: 0} 5
```

In [114]:
```
        # vendo o gráfico
        plt.plot(cfA.keys(), cfA.values())
        plt.plot(cfB.keys(), cfB.values())
```

Out[114]:
```
[<matplotlib.lines.Line2D at 0x7f4acd143048>]
```



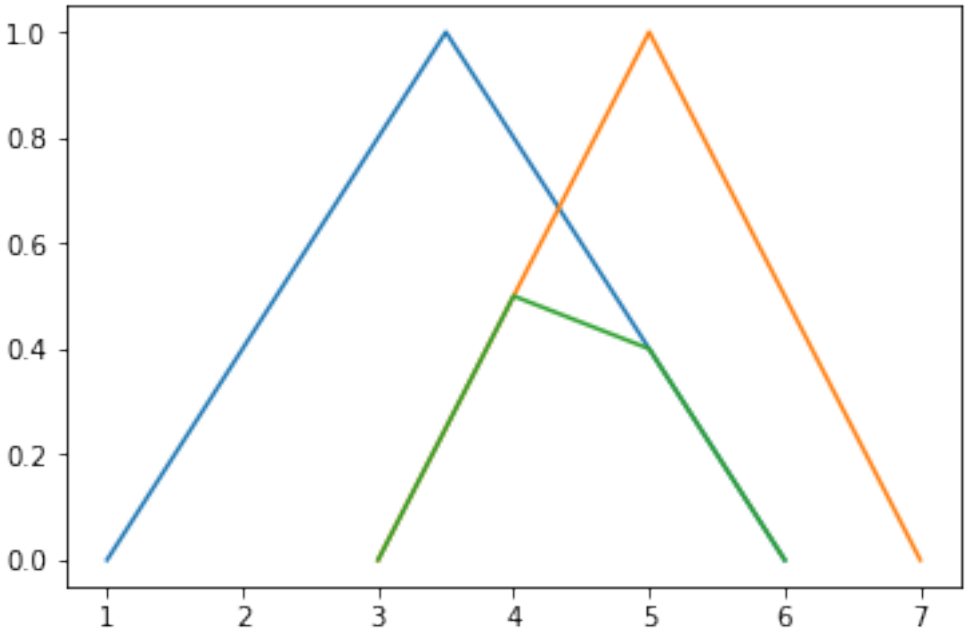
1.1 ## Operações padrão

1.1.1 Intersecção

(A B) (x) = min(A(x), B(x))

```
In [115]: # mínimo ponto da intersecção dos conjuntos eu encontro
          # o maior grau de pertinência.

          def intersection_fuzzy(cfA,cfB):
              chaves = list(set(cfA) & set(cfB))
              inter = {}
              for i in chaves:
                  value = min(cfA[i], cfB[i])
                  inter[i] = value
              return inter

          AIB = intersection_fuzzy(cfA, cfB)

          AIB

Out[115]: {3: 0, 4: 0.5, 5: 0.4, 6: 0}

In [116]: plt.plot(cfA.keys(), cfA.values())
          plt.plot(cfB.keys(), cfB.values())
          plt.plot(AIB.keys(), AIB.values())
```

Out[116]: [<matplotlib.lines.Line2D at 0x7f4acd0e6f28>]



1.1.2 União

(A U B) (x) = max(A(x), B(x))

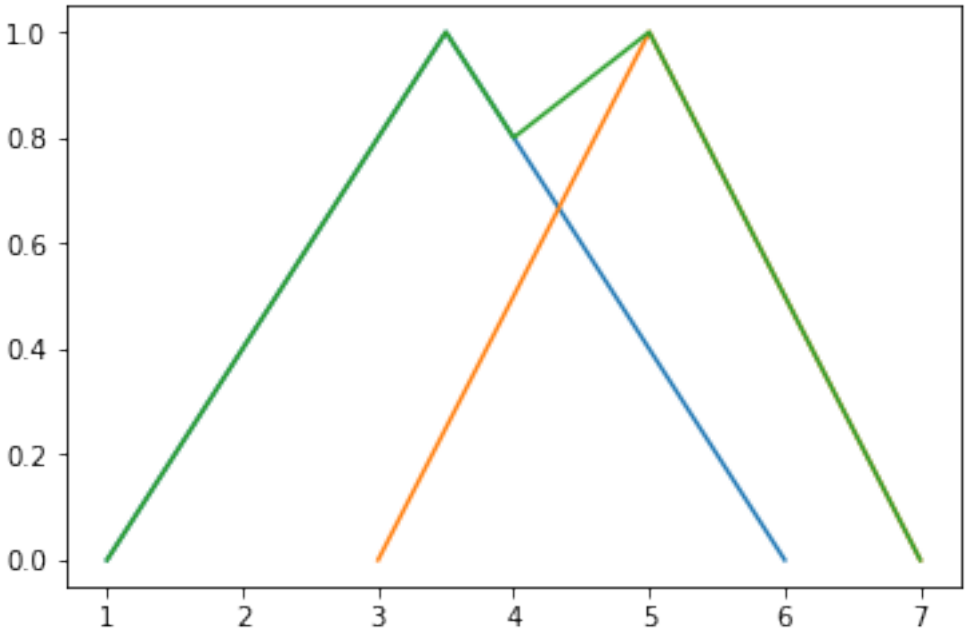
```
In [117]: def union_fuzzy(cfA,cfB):
              chaves = list(set(cfA).union(cfB))
              print(chaves)
              inter = {}
              for i in chaves:
                  if i in cfA and i in cfB: # se tiverem a mesma chave
                      value = max(cfA[i], cfB[i])
                      inter[i] = value
                  else:
                      if i in cfA:
                          inter[i] = cfA[i]
                      else:
                          inter[i] = cfB[i]

              return inter

          AUB = union_fuzzy(cfA, cfB)
          AUB
```

```
[1, 2, 3, 3.5, 4, 5, 6, 7]
```

```
Out[117]: {1: 0, 2: 0.4, 3: 0.8, 3.5: 1.0, 4: 0.8, 5: 1.0, 6: 0.5, 7: 0}
```

```
In [118]: plt.plot(cfA.keys(), cfA.values())
          plt.plot(cfB.keys(), cfB.values())
          plt.plot(AUB.keys(), AUB.values())
```

```
Out[118]: [<matplotlib.lines.Line2D at 0x7f4acd04f080>]
```



1.1.3 Complemento

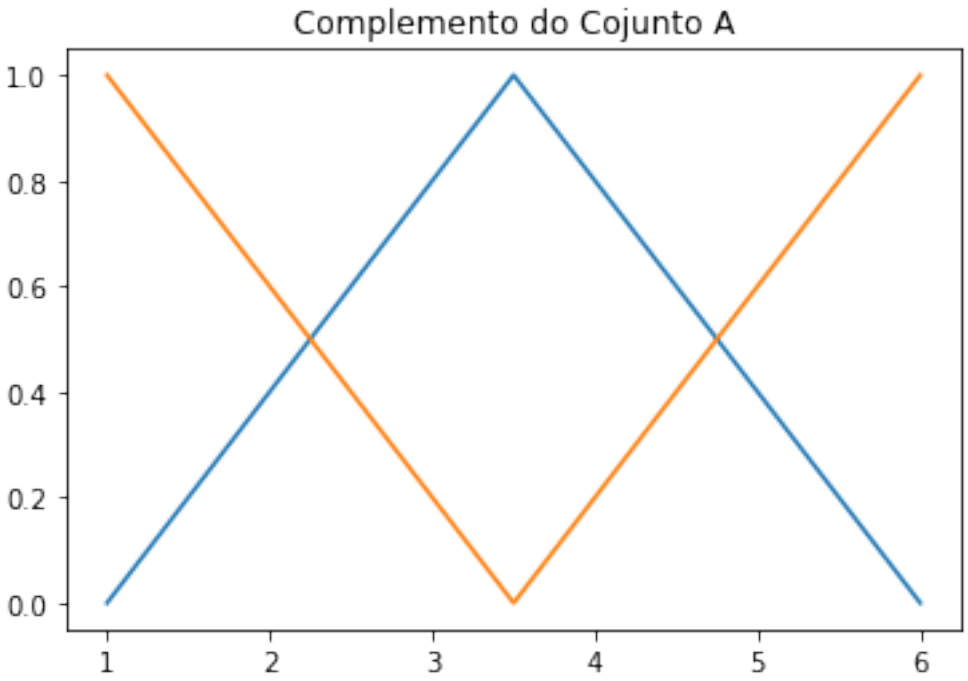
$A'(x) = 1 - A$

```
In [123]: def complemento_fuzzy(conj):
              cj = {}
              for key in conj:
                  cj[key] = 1-conj[key]
              return cj
```

```
In [124]: # complemento de A
          c_cfA = complemento_fuzzy(cfA)
          print(cfA)
          print(c_cfA)

          plt.plot(cfA.keys(), cfA.values())
          plt.plot(c_cfA.keys(), c_cfA.values())
          plt.title('Complemento do Cojunto A')
```

```
{1: 0, 2: 0.4, 3: 0.8, 3.5: 1.0, 4: 0.8, 5: 0.4, 6: 0}
{1: 1, 2: 0.6, 3: 0.19999999999999996, 3.5: 0.0, 4: 0.19999999999999996, 5: 0.6, 6: 1}
```

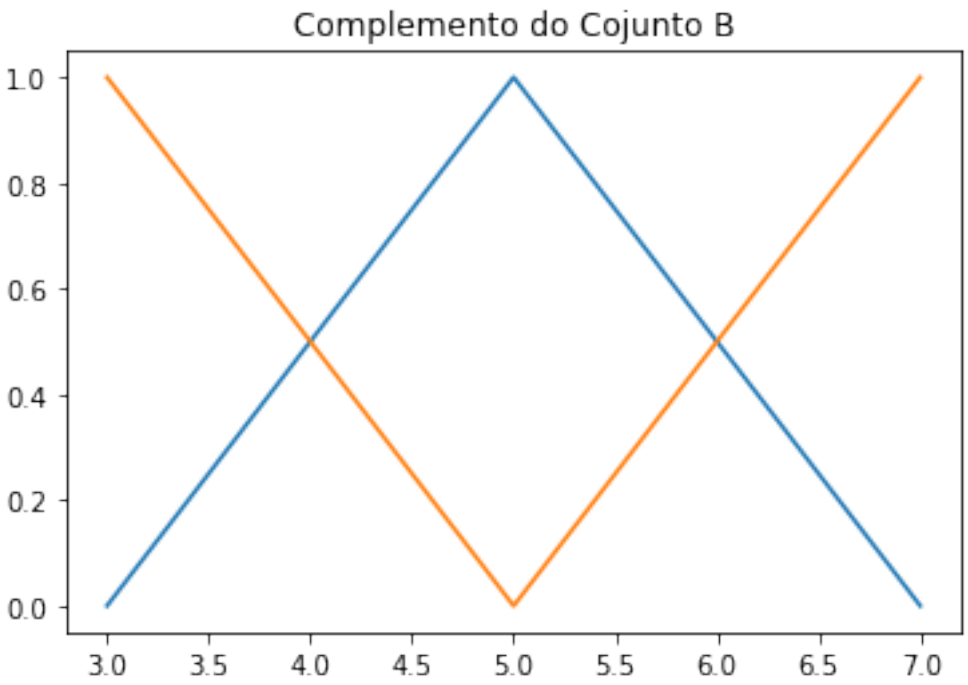
Out[124]: Text(0.5,1,'Complemento do Cojunto A')



In [126]:
```
# complemento de B
c_cfB = complemento_fuzzy(cfB)
print(cfA)
print(c_cfB)

plt.plot(cfB.keys(), cfB.values())
plt.plot(c_cfB.keys(), c_cfB.values())
plt.title('Complemento do Cojunto B')
```

```
{1: 0, 2: 0.4, 3: 0.8, 3.5: 1.0, 4: 0.8, 5: 0.4, 6: 0}
{3: 1, 4: 0.5, 5: 0.0, 6: 0.5, 7: 1}
```

Out[126]: Text(0.5,1,'Complemento do Cojunto B')



1.2 ## Operações Generalizadas

1.2.1 T-Normas e intersecção generalizada