Tarea 1.5 Operaciones con conjuntos difusos discretos y continuos

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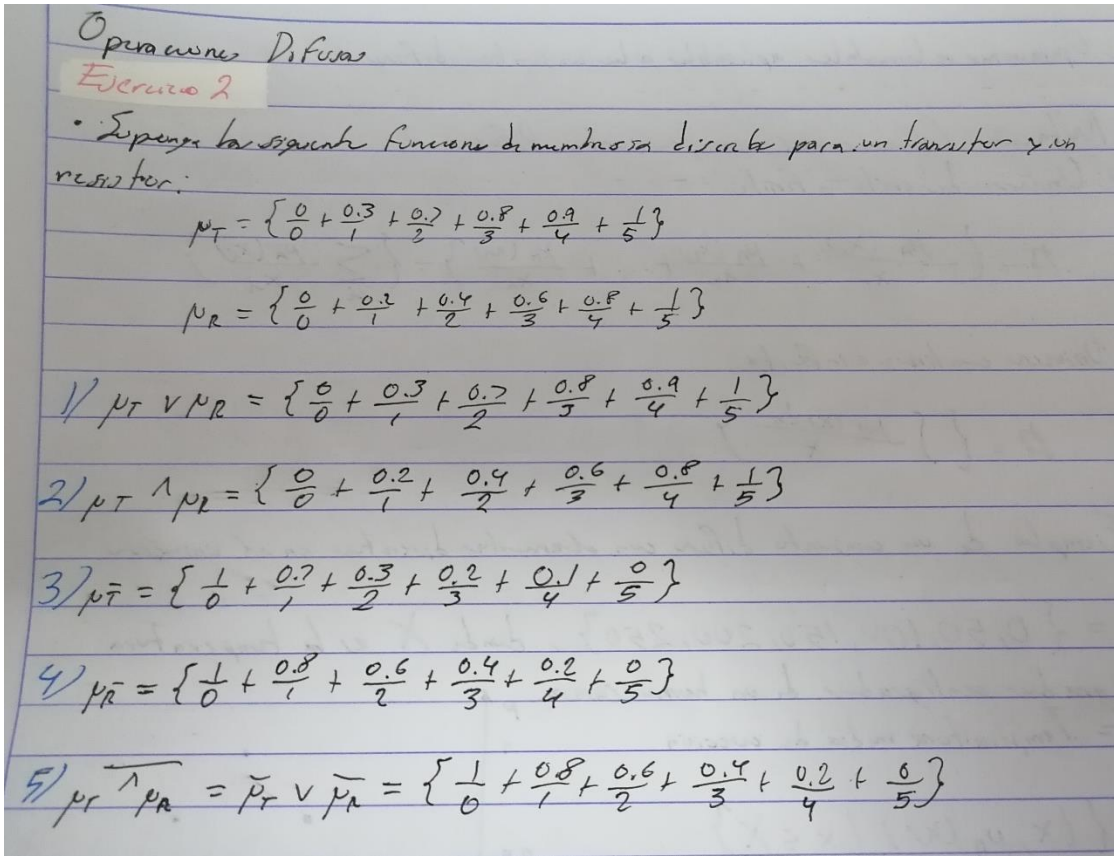
2TM9

Ejercicio 2:

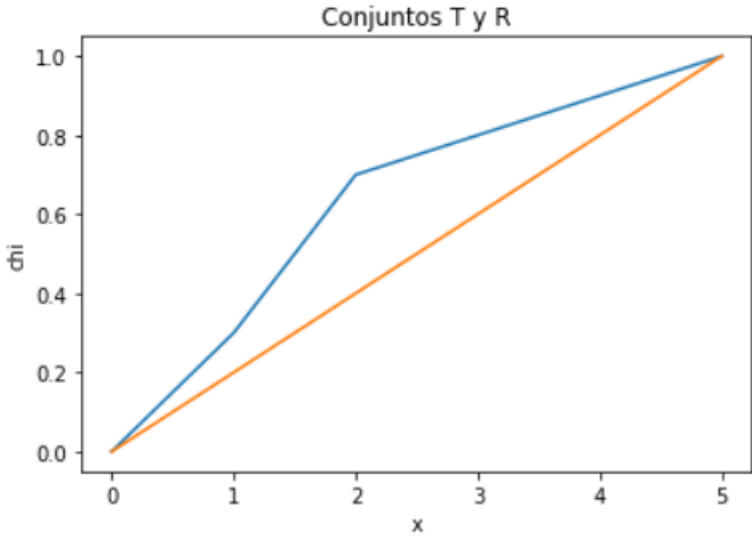


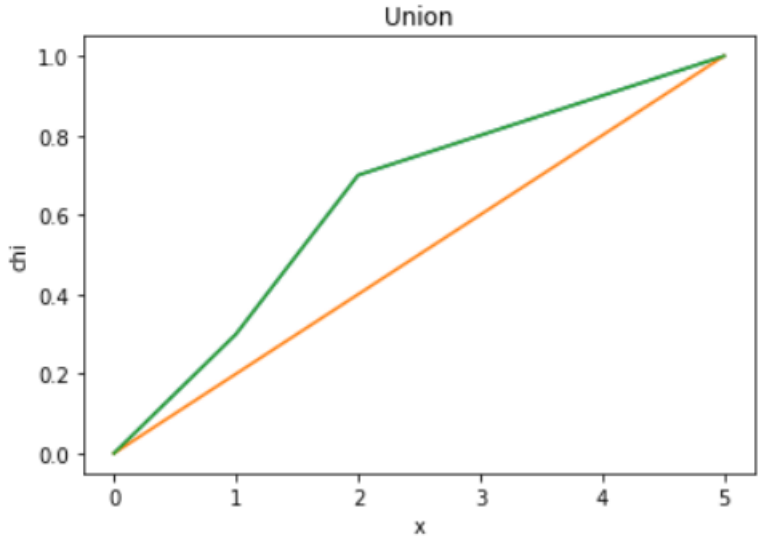
Código de Python:

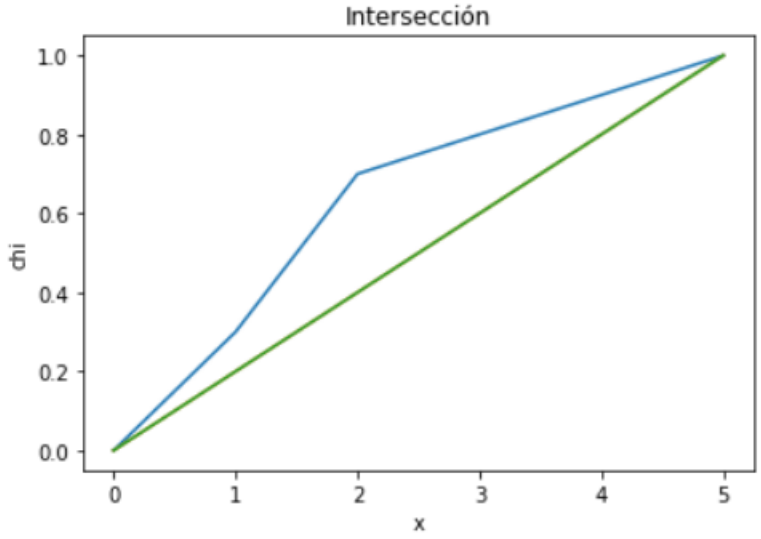
```
import numpy as np
import matplotlib.pyplot as plt


x = np.arange(0, 6, 1)  # Rango del universo
T = [ 0, 0.3, 0.7, 0.8, 0.9, 1 ]
```

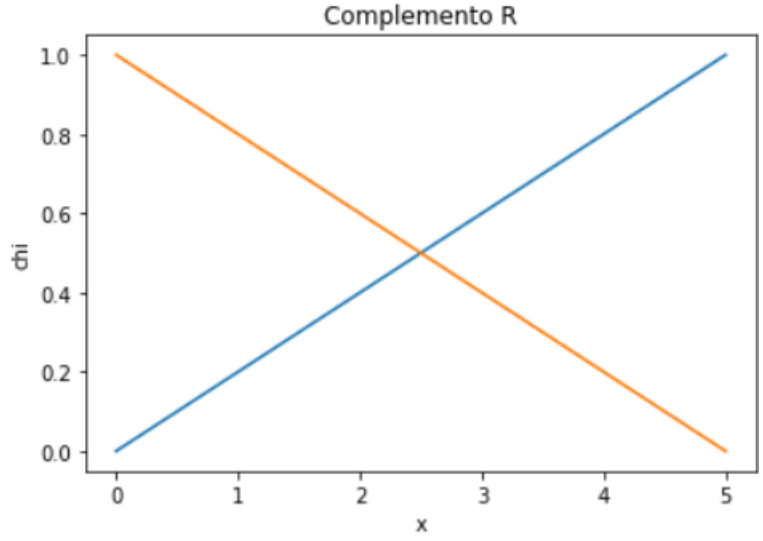
```
R = [ 0, 0.2, 0.4, 0.6, 0.8, 1 ]

union = np.zeros(len(x))
intersec = np.zeros(len(x))
compT = np.zeros(len(x))
compR = np.zeros(len(x))
leyMoore =  np.zeros(len(x))

plt.figure(1)
plt.title("Conjuntos T y R")
plt.xlabel("x")
plt.ylabel("chi")
plt.plot(x, T, x, R)


for i in range(len(x)):

  #Union
  if T[i] > R[i]:
    union[i] = T[i]
  else:
    union[i] = R[i]

  #Intersección
  if T[i] < R[i]:
    intersec[i] = T[i]
  else:
    intersec[i] = R[i]

  #Complementos
  compT[i] = 1 - T[i]
  compR[i] = 1 - R[i]

  #Moore
  if compT[i] > compR[i]:
    leyMoore[i] = compT[i]
  else:
    leyMoore[i] = compR[i]

plt.figure(2)
plt.title("Union")
plt.xlabel("x")
plt.ylabel("chi")
plt.plot(x, T, x, R, x, union)
```

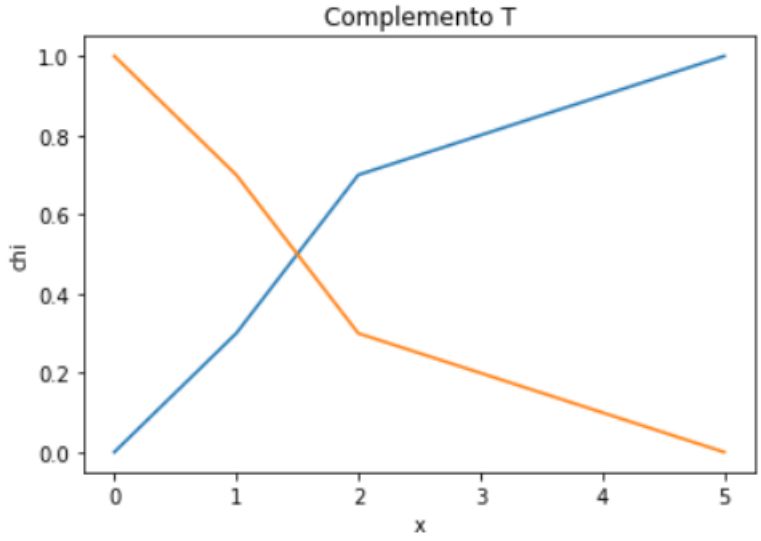
```
plt.figure(3)
plt.title("Intersección")
plt.xlabel("x")
plt.ylabel("chi")
plt.plot(x, T, x, R, x, intersec)

plt.figure(4)
plt.title("Complemento R")
plt.xlabel("x")
plt.ylabel("chi")
plt.plot(x, R, x, compR)

plt.figure(5)
plt.title("Complemento T")
plt.xlabel("x")
plt.ylabel("chi")
plt.plot(x, T, x, compT)

plt.figure(6)
plt.title("Segunda ley de Moore")
plt.xlabel("x")
plt.ylabel("chi")
plt.plot(x, T, x, R, x, leyMoore)
```

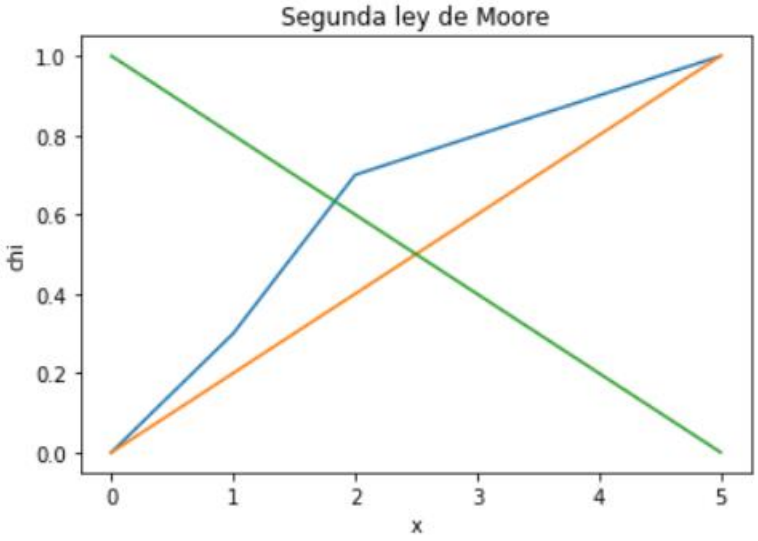



Union
1.0
0.8
0.6
0.4
0.2
0.0
chi
0
1
2
3
4
5
x

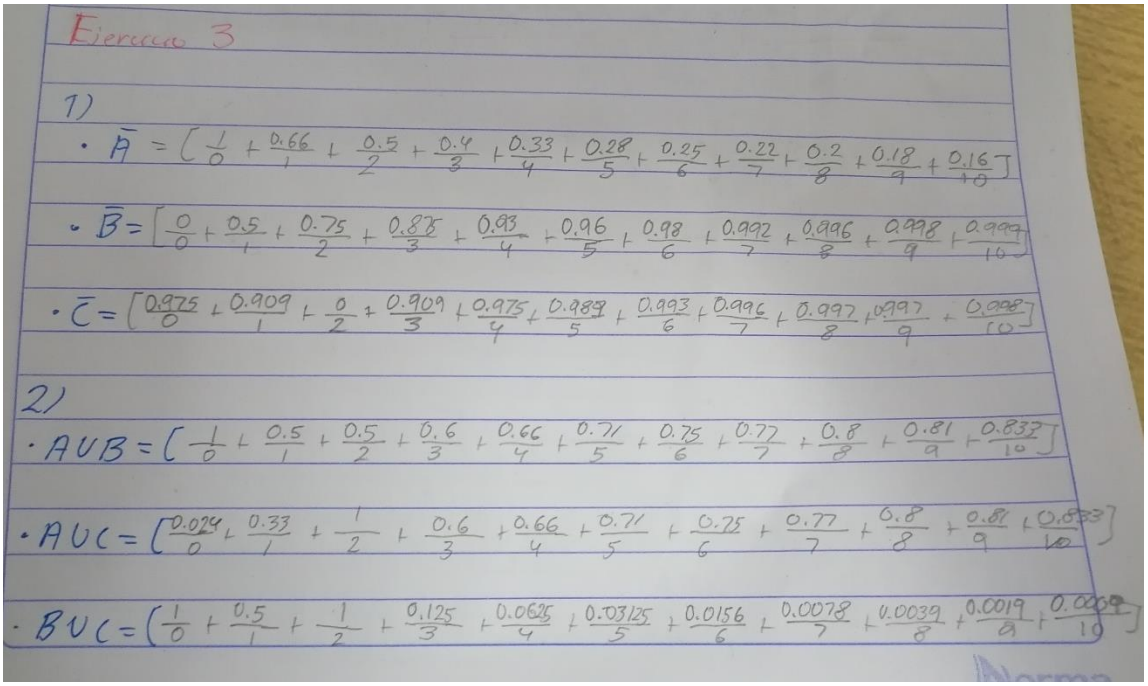

Intersección
1.0
0.8
0.6
0.4
0.2
0.0
chi
0
1
2
3
4
5
x

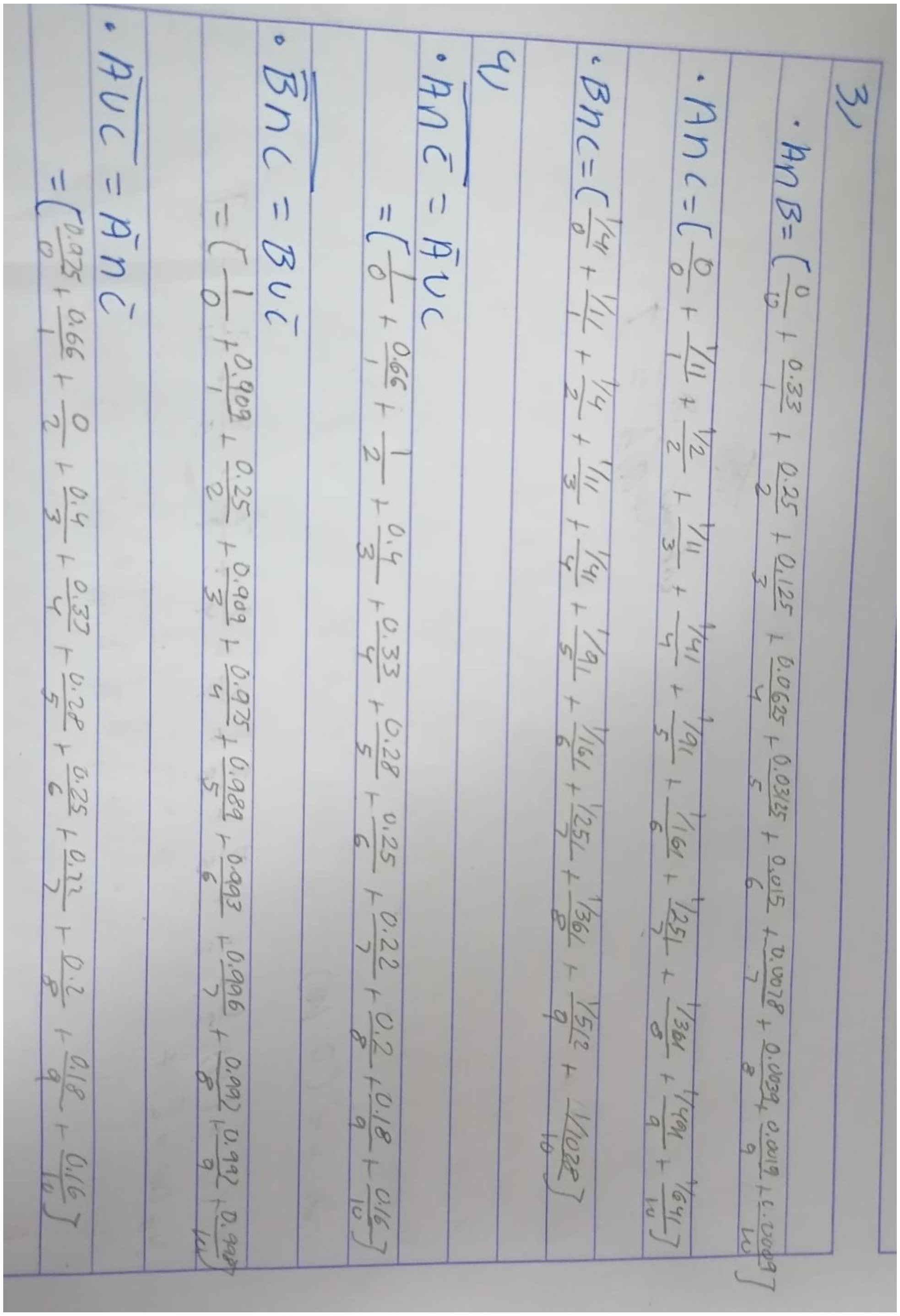

Complemento R
1.0
0.8
0.6
0.4
0.2
0.0
chi
0
1
2
3
4
5
x


Complemento T
1.0
0.8
0.6
0.4
0.2
0.0
chi
0
1
2
3
4
5
x


Segunda ley de Moore
1.0
0.8
0.6
0.4
0.2
0.0
chi
0
1
2
3
4
5
x

Ejercicio 3:


Ejercicio 3
1)
$\bar{A} = \left[\frac{1}{0} + \frac{0.66}{1} + \frac{0.5}{2} + \frac{0.4}{3} + \frac{0.33}{4} + \frac{0.28}{5} + \frac{0.25}{6} + \frac{0.22}{7} + \frac{0.2}{8} + \frac{0.18}{9} + \frac{0.16}{10}\right]$
$\bar{B} = \left[\frac{0}{0} + \frac{0.5}{1} + \frac{0.75}{2} + \frac{0.875}{3} + \frac{0.93}{4} + \frac{0.96}{5} + \frac{0.98}{6} + \frac{0.992}{7} + \frac{0.996}{8} + \frac{0.998}{9} + \frac{0.999}{10}\right]$
$\bar{C} = \left[\frac{0.975}{0} + \frac{0.909}{1} + \frac{0}{2} + \frac{0.909}{3} + \frac{0.975}{4} + \frac{0.989}{5} + \frac{0.993}{6} + \frac{0.996}{7} + \frac{0.997}{8} + \frac{0.997}{9} + \frac{0.998}{10}\right]$
2)
$A \cup B = \left[\frac{1}{0} + \frac{0.5}{1} + \frac{0.5}{2} + \frac{0.6}{3} + \frac{0.66}{4} + \frac{0.71}{5} + \frac{0.75}{6} + \frac{0.77}{7} + \frac{0.8}{8} + \frac{0.81}{9} + \frac{0.833}{10}\right]$
$A \cup C = \left[\frac{0.024}{0} + \frac{0.33}{1} + \frac{1}{2} + \frac{0.6}{3} + \frac{0.66}{4} + \frac{0.71}{5} + \frac{0.75}{6} + \frac{0.77}{7} + \frac{0.8}{8} + \frac{0.81}{9} + \frac{0.833}{10}\right]$
$B \cup C = \left(\frac{1}{0} + \frac{0.5}{1} + \frac{1}{2} + \frac{0.125}{3} + \frac{0.0625}{4} + \frac{0.03125}{5} + \frac{0.0156}{6} + \frac{0.0078}{7} + \frac{0.0039}{8} + \frac{0.0019}{9} + \frac{0.0009}{10}\right]$


3)

• $A \cap B = [\frac{0}{0} + \frac{0.33}{1} + \frac{0.25}{2} + \frac{0.125}{3} + \frac{0.0625}{4} + \frac{0.03125}{5} + \frac{0.015}{6} + \frac{0.0078}{7} + \frac{0.0039}{8} + \frac{0.0019}{9} + \frac{0.0009}{10}]$

• $A \cap C = [\frac{0}{0} + \frac{1/11}{1} + \frac{1/2}{2} + \frac{1/11}{3} + \frac{1/41}{4} + \frac{1/91}{5} + \frac{1/161}{6} + \frac{1/251}{7} + \frac{1/361}{8} + \frac{1/491}{9} + \frac{1/641}{10}]$

• $B \cap C = [\frac{1/41}{0} + \frac{1/11}{1} + \frac{1/4}{2} + \frac{1/11}{3} + \frac{1/41}{4} + \frac{1/91}{5} + \frac{1/161}{6} + \frac{1/251}{7} + \frac{1/361}{8} + \frac{1/512}{9} + \frac{1/1028}{10}]$

4)

• $\overline{A \cap \bar{C}} = \bar{A} \cup C$

$= [\frac{1}{0} + \frac{0.66}{1} + \frac{1}{2} + \frac{0.4}{3} + \frac{0.33}{4} + \frac{0.28}{5} + \frac{0.25}{6} + \frac{0.22}{7} + \frac{0.2}{8} + \frac{0.18}{9} + \frac{0.16}{10}]$

• $\overline{\bar{B} \cap C} = B \cup \bar{C}$

$= [\frac{1}{0} + \frac{0.909}{1} + \frac{0.25}{2} + \frac{0.909}{3} + \frac{0.975}{4} + \frac{0.989}{5} + \frac{0.993}{6} + \frac{0.996}{7} + \frac{0.992}{8} + \frac{0.992}{9} + \frac{0.998}{10}]$

• $\overline{A \cup C} = \bar{A} \cap \bar{C}$

$= [\frac{0.975}{0} + \frac{0.66}{1} + \frac{0}{2} + \frac{0.4}{3} + \frac{0.37}{4} + \frac{0.28}{5} + \frac{0.25}{6} + \frac{0.22}{7} + \frac{0.2}{8} + \frac{0.18}{9} + \frac{0.16}{10}]$

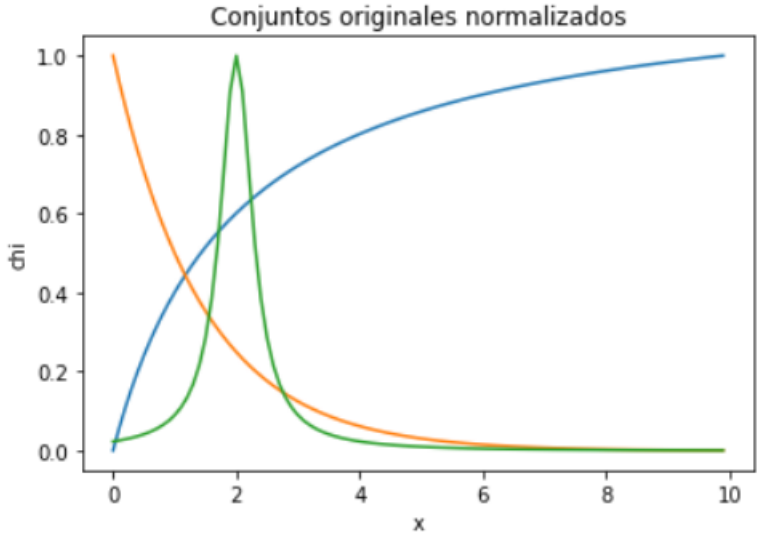
Código de Python:

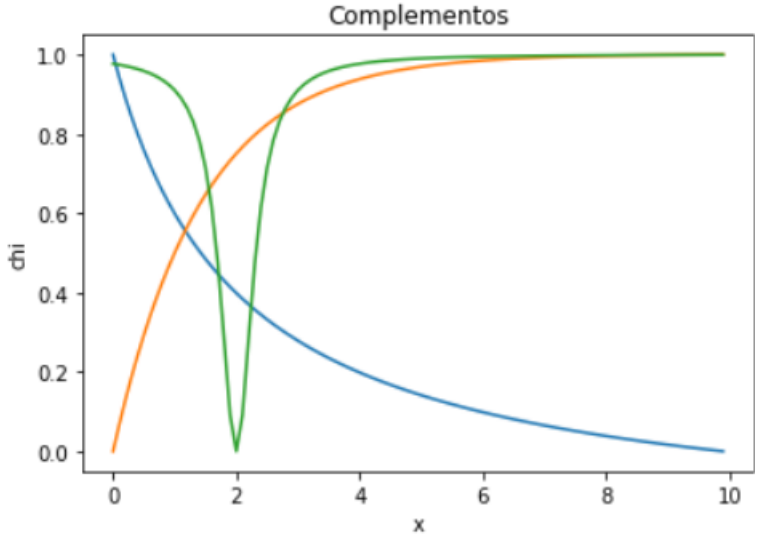
```
from numpy.ma.core import minimum
import numpy as np
import matplotlib.pyplot as plt
```

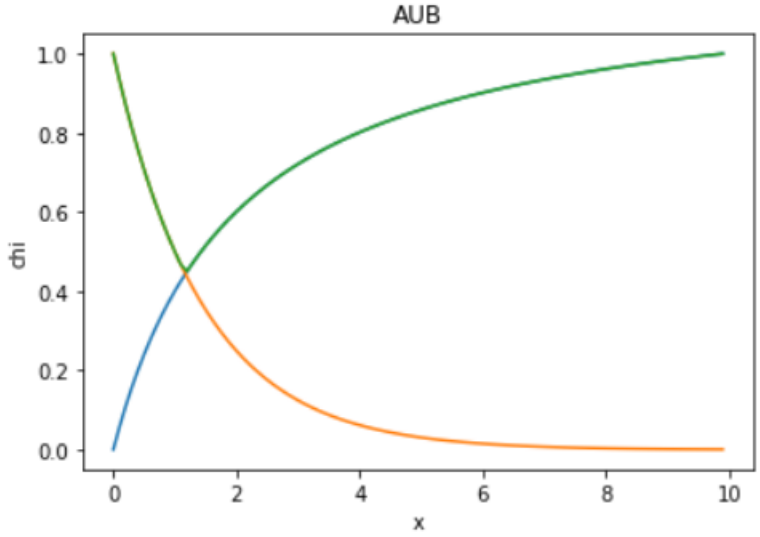
```
x = np.arange(0, 10, 0.1)  # Rango del universo
A = np.zeros(len(x))
B = np.zeros(len(x))
C = np.zeros(len(x))

compA = np.zeros(len(x))
compB = np.zeros(len(x))
compC = np.zeros(len(x))

unionAB = np.zeros(len(x))
unionAC = np.zeros(len(x))
unionBC = np.zeros(len(x))

intersecAB = np.zeros(len(x))
intersecAC = np.zeros(len(x))
intersecBC = np.zeros(len(x))

intersecACcc = np.zeros(len(x))
intersecBcCc = np.zeros(len(x))
unionACc = np.zeros(len(x))

for i in range(len(x)):
  iN = i/10
  A[i] = iN/(iN+2)
  B[i] = pow(2,- iN)
  C[i] = 1/(1+10*pow((iN-2),2))

#Normalización
A = (A - np.min(A))/(np.max(A) - np.min(A))
B = (B - np.min(B))/(np.max(B) - np.min(B))
C = (C - np.min(C))/(np.max(C) - np.min(C))


plt.figure(1)
plt.title("Conjuntos originales normalizados")
plt.plot(x,A,x,B,x,C)


for i in range(len(x)):
  #Complementos
  compA[i] = 1 - A[i]
  compB[i] = 1 - B[i]
  compC[i] = 1 - C[i]

  #Uniones
```

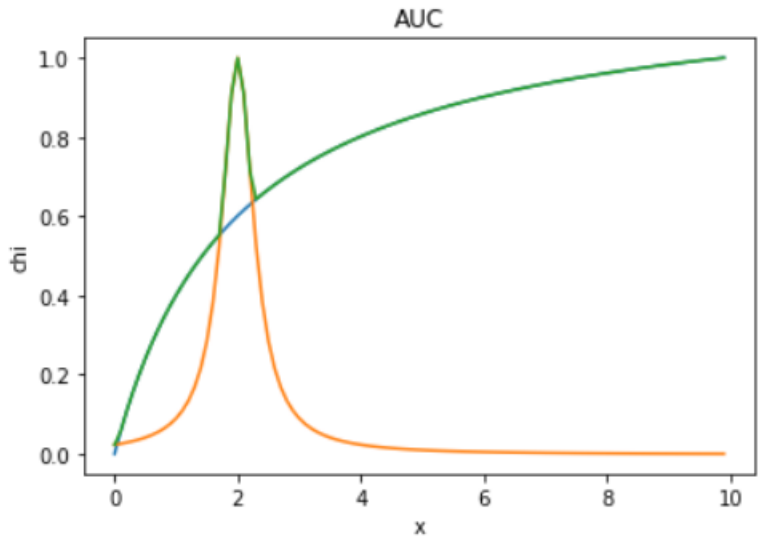
```
  #AUB
  unionAB[i] = np.maximum(A[i],B[i])
  #AUC
  unionAC[i] = np.maximum(A[i],C[i])
  #BUC
  unionBC[i] = np.maximum(B[i],C[i])

  #Intersecciones
  #AnB
  intersecAB[i] = minimum(A[i],B[i])
  #AnC
  intersecAC[i] = minimum(A[i],C[i])
  #BnC
  intersecBC[i] = minimum(B[i],C[i])

  #Leyes de Moore
  intersecACcc[i] = np.maximum(compA[i],C[i])
  intersecBcCc[i] = np.maximum(B[i],compC[i])
  unionACc[i] = np.minimum(compA[i],compC[i])




plt.figure(2)
plt.title("Complementos")
plt.xlabel("x")
plt.ylabel("chi")
plt.plot(x,compA,x,compB,x,compC)

plt.figure(3)
plt.title("AUB")
plt.xlabel("x")
plt.ylabel("chi")
plt.plot(x,A,x,B,x,unionAB)

plt.figure(4)
plt.title("AUC")
plt.xlabel("x")
plt.ylabel("chi")
plt.plot(x,A,x,C,x,unionAC)

plt.figure(5)
plt.title("BUC")
plt.xlabel("x")
plt.ylabel("chi")
```

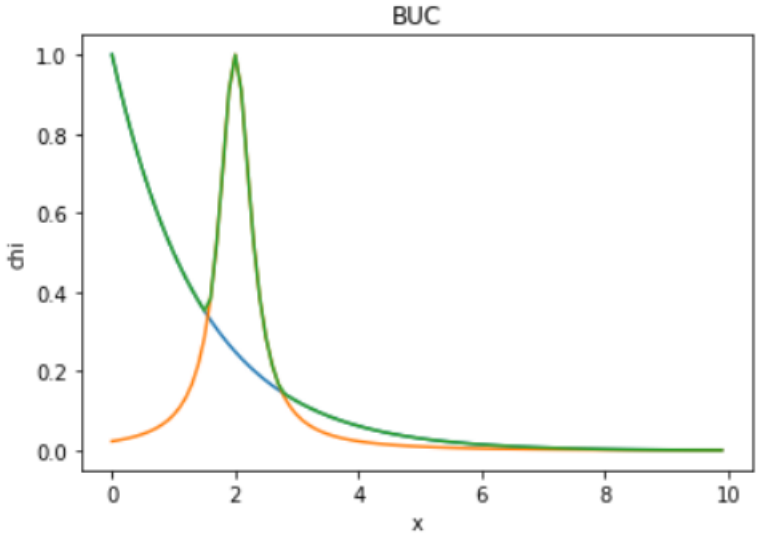
```
plt.plot(x,B,x,C,x,unionBC)

plt.figure(6)
plt.title("AnB")
plt.xlabel("x")
plt.ylabel("chi")
plt.plot(x,A,x,B,x,intersecAB)

plt.figure(7)
plt.title("AnC")
plt.xlabel("x")
plt.ylabel("chi")
plt.plot(x,A,x,C,x,intersecAC)

plt.figure(8)
plt.title("BnC")
plt.xlabel("x")
plt.ylabel("chi")
plt.plot(x,B,x,C,x,intersecBC)

plt.figure(9)
plt.title("(AnC')'")
plt.xlabel("x")
plt.ylabel("chi")
plt.plot(x,A,x,C,x,intersecACcc)

plt.figure(10)
plt.title("(B'nC)'")
plt.xlabel("x")
plt.ylabel("chi")
plt.plot(x,B,x,C,x,intersecBcCc)

plt.figure(11)
plt.title("(AUC)'")
plt.xlabel("x")
plt.ylabel("chi")
plt.plot(x,A,x,C,x,unionACc)
```

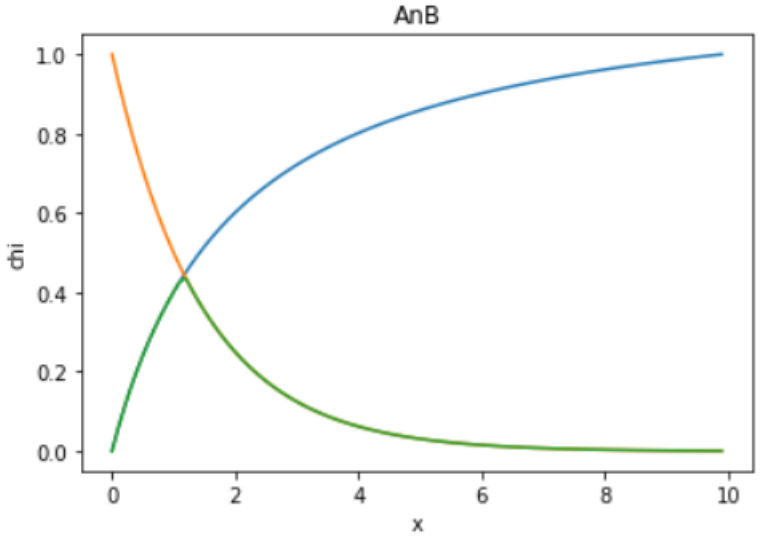

Conjuntos originales normalizados
chi
x
0.0
0.2
0.4
0.6
0.8
1.0
0
2
4
6
8
10

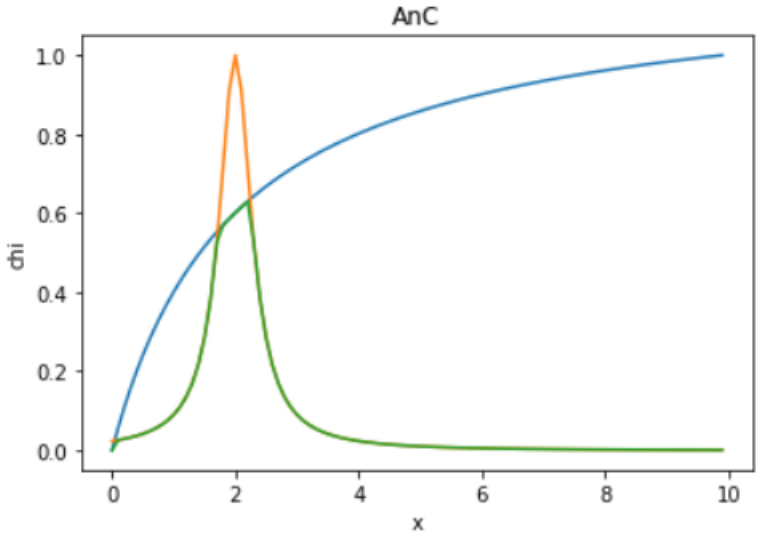

Complementos
chi
x
0.0
0.2
0.4
0.6
0.8
1.0
0
2
4
6
8
10

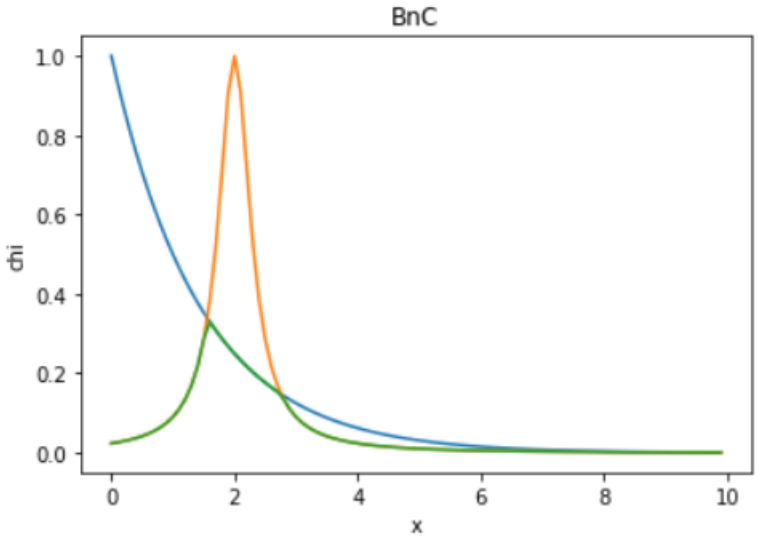

AUB
chi
x
0.0
0.2
0.4
0.6
0.8
1.0
0
2
4
6
8
10

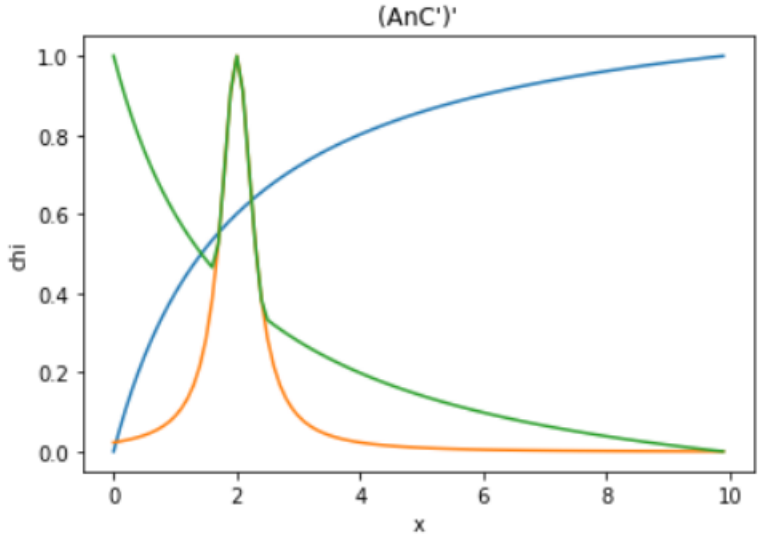

AUC
chi
x
0.0
0.2
0.4
0.6
0.8
1.0
0
2
4
6
8
10

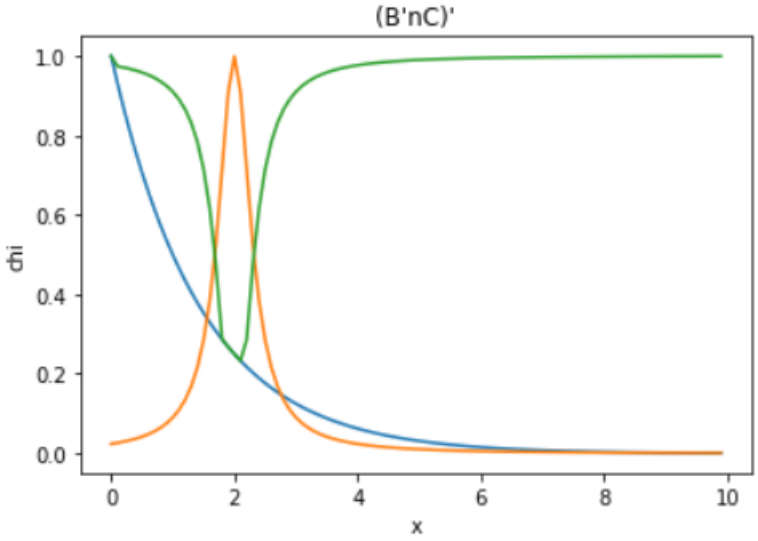

BUC
chi
x
0.0
0.2
0.4
0.6
0.8
1.0
0
2
4
6
8
10

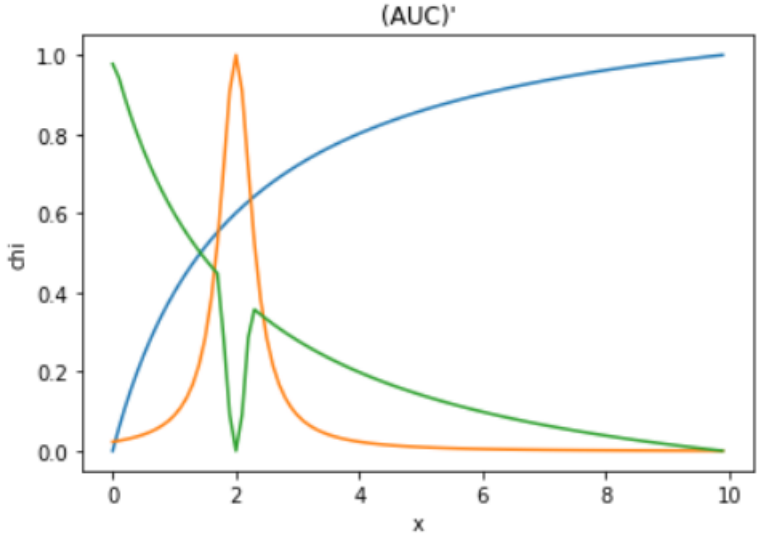

AnB
chi
x
0.0
0.2
0.4
0.6
0.8
1.0
0
2
4
6
8
10


AnC
chi
x
0.0
0.2
0.4
0.6
0.8
1.0
0
2
4
6
8
10


BnC
chi
x
0.0
0.2
0.4
0.6
0.8
1.0
0
2
4
6
8
10


(AnC')'
chi
x
0.0
0.2
0.4
0.6
0.8
1.0
0
2
4
6
8
10


(B'nC)'
chi
x
0.0
0.2
0.4
0.6
0.8
1.0
0
2
4
6
8
10


(AUC)'
chi
x
0.0
0.2
0.4
0.6
0.8
1.0
0
2
4
6
8
10