Exp: 9 (Uncertain Methods)

AIM: Implementation of uncertain methods (Dampster Shafer Theory).

PROBLEM FORMULATION:

To solve inference problem representing uncertain method to obtain a belief function. Using the mass function which has built in combination rules obtain the Dampster rule of combination.

INITIAL STATE:

m1 : {'a' : 0.4 , 'b' : 0.2 . 'ab' : 0.1 , 'abc' : 0.3}

m2 : {'b' : 0.5 , 'c' : 0.2 , 'ac' : 0.3 , 'a' : 0.0}

FINAL STATE:

{'ac' : 0.157894 , 'c' : 0.105263 , 'b' : 0.5263157, 'ab' : 0.0 , 'abc' : 0.0 , 'a' : 0.21052631}

PROBLEM SOLVING:

The combination is calculated from the two sets of masses m_1 & m_2 in the following manner :

- $m_{1,2}(\phi) = 0$
- $m_{1,2}(A) = (m_1 \oplus m_2)(A) = \frac{1}{1-k} \sum_{B \cap C = A \neq \phi} m_1(B) m($

where, $k = \sum_{B \cap C = \phi} m_1(B)\, m_2(C)$

combination of m_1 & m_2

{'b'} : 0.5 , {'a'} : 0.2499, {'c', 'a'} : 0.1499, {c} : 0.0999

ALGORITHM:-

Step 1: Start

Step 2: Each piece of evidence is represented by a separate belief function

Step 3: Combination rules are then used to successively fuse all these belief
functions in order to obtain a belief function representing all available evidence.

Step 4: Specifically, the combination (called the joint mass) is calculated from
the two sets of masses m1 and m2 in the following manner:

- $m_{1,2}(\varnothing) = 0$
- $m_{1,2}(A)=(m_1 \oplus m_2)(A)=(1/1-K)\ \sum_{B\cap C=A\neq\varnothing} m_1(B)\, m_2(C)$

where,

- $K=\sum_{B\cap C=\varnothing} m_1(B)\, m_2(C)\ K$

K is a measure of the amount of conflict between the two mass sets.

Step 5: In python Mass-Function has the built-in combination rules.

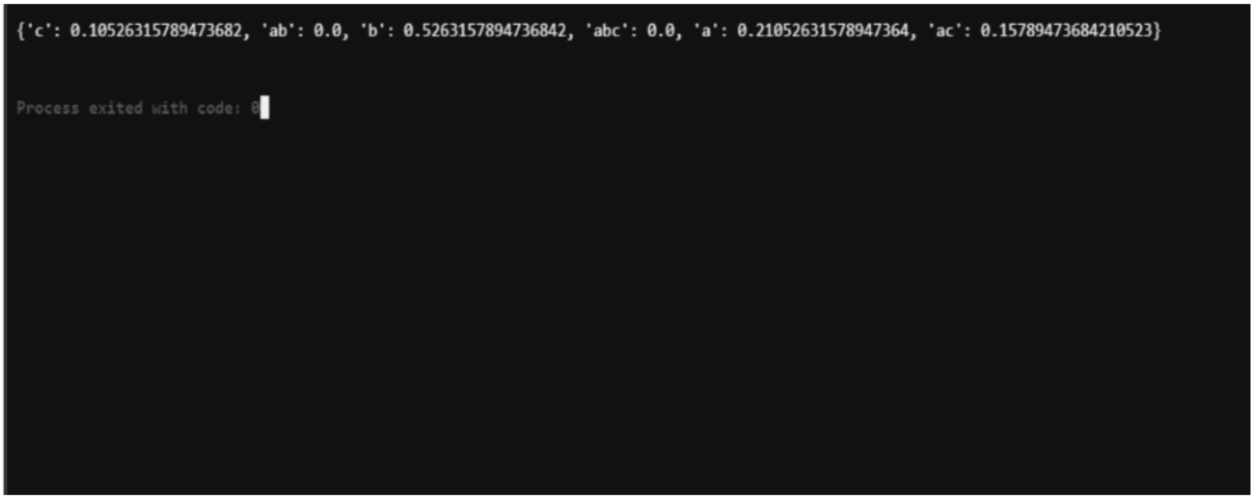
Step 6: Stop

CODE:-

```
from numpy import *
def DempsterRule(m1, m2):
## extract the frame of discernment
sets=set(m1.keys()).union(set(m2.keys()))
result=dict.fromkeys(sets,0)
## Combination process
for i in m1.keys():
for j in m2.keys():
if set(str(i)).intersection(set(str(j))) == set(str(i)):
result[i]+=m1[i]*m2[j]
elif set(str(i)).intersection(set(str(j))) == set(str(j)):
result[j]+=m1[i]*m2[j]
## normalize the results
f= sum(list(result.values()))
for i in result.keys():
result[i] /=f
return result

m1 = {'a':0.4, 'b':0.2, 'ab':0.1, 'abc':0.3}
m2 = {'b':0.5, 'c':0.2, 'ac':0.3, 'a':0.0}
print(DempsterRule(m1, m2))
```

OUTPUT:-



```
{'c': 0.10526315789473682, 'ab': 0.0, 'b': 0.5263157894736842, 'abc': 0.0, 'a': 0.21052631578947364, 'ac': 0.15789473684210523}


Process exited with code: 0
```

RESULT:-

Hence, the Implementation of Dempster Shafer Theory is done successfully.