<table>
<tr>
<td>Date:
Ex No:

6.2</td>
<td>Title of the Lab
Implementation of Dempster Shafer Theory</td>
<td>Name: Yuvraj Singh Chauhan
Registration Number:

RA1911027010058
Section: N1
Lab Batch: 1
Day Order: 3</td>
</tr>
</table>

AIM:

To implement Dempster Shafer Theory.

Description of the Concept or Problem given:

Dempster-Shafer Theory is a mathematical theory of evidence, offers an alternative to traditional probabilistic theory for the mathematical representation of uncertainty. The significant innovation of this framework is that it allows for the allocation of a probability mass to sets or intervals as opposed to mutually exclusive singletons. D-S is a potentially valuable tool for the evaluation of risk and reliability in engineering applications when it is not possible to obtain a precise measurement from experiments, or when knowledge is obtained from expert elicitation. An important aspect of D-S theory is the combination of evidence obtained from multiple sources and the modelling of conflict between them.

Manual Solution:

1. **Mass functions** denoted by m: A mass function is in many respects the most fundamental belief representation and all other representations can be easily obtained from a mass function. Formally, a mass function is a mapping assigning a mass value to each hypothesis belongs to of the frame of discernment is the amount of belief strictly committed to hypothesis.
2. **Belief functions** denoted by bel: The total amount of belief committed to a hypothesis, including all subsets is denoted by bel(A). The function is called a belief function. It can be directly computed from a mass function. A belief function is sometimes interpreted as de

fining a “lower bound” for an unknown probability function.

3. **Plausibility functions** denoted by pl: The plausibility is the amount of belief not strictly committed to the complement. It therefore expresses how plausible a hypothesis is, i.e., how much belief mass potentially supports. Whereas can be viewed as a lower bound for an unknown probability function. Under a lower and upper probability interpretation, the plausibility can be viewed as an “upper bound”.
4. **Commonality functions** denoted by q: The commonality states how much mass in total is committed to and all of the supersets with as its subset. The commonality therefore expresses how much mass potentially supports the entire set.
5. Test the various belief functions from the pyds MassFunction.
6. Print the MassFunction frame of discernment and the powerset.

Program Implementation [Coding]:

```
from Pyds import *
m1 = MassFunction({'a':0.4, 'b':0.2, 'ab':0.1, 'abc':0.3})
m2 = MassFunction({'b':0.5, 'c':0.2, 'ac':0.3, 'a':0.0})
print("m1:",m1)
print("m1: bpa of {'a','b'}=", m1['ab'])
print("m1: belief of {'a','b'}=", m1.bel('ab'))
print("m1: plausibility of {'a','b'}=", m1.pl('ab'))
print("m1: commonality of {'a','b'}=", m1.q('ab'))
print("m2:",m2)
print("m2: bpa of {'b'}=", m2['b'])
print("m2: belief of {'b'}=", m2.bel('b'))
print("m2: plausibility of {'b'}=", m2.pl('b'))
print("m2: commonality of {'b'}=", m2.q('b'))
m1_1 = MassFunction([(('a',), 0.4), (('b',), 0.2), (('a', 'b'), 0.1), (('a', 'b', 'c'), 0.3)])
if (m1_1==m1):
   print("m1_1 Equal to m1")
m1_2 = MassFunction([('a', 0.4), ('b', 0.2), ('ab', 0.1), ('abc', 0.3)])
if (m1_2==m1):
   print("m1_2 Equal to m1")
print("frame of discernment", m1.frame())
print("powerset of frame", list(m1.all()))
```

Screenshots of the Outputs:

```
m1: {{'a'}:0.4; {'a', 'b', 'c'}:0.3; {'b'}:0.2; {'a', 'b'}:0.1}
m1: bpa of {'a','b'}= 0.1
m1: belief of {'a','b'}= 0.7000000000000001
m1: plausibility of {'a','b'}= 1.0
m1: commonality of {'a','b'}= 0.4
m2: {{'b'}:0.5; {'a', 'c'}:0.3; {'c'}:0.2; {'a'}:0.0}
m2: bpa of {'b'}= 0.5
m2: belief of {'b'}= 0.5
m2: plausibility of {'b'}= 0.5
m2: commonality of {'b'}= 0.5
m1_1 Equal to m1
m1_2 Equal to m1
frame of discernment frozenset({'a', 'c', 'b'})
powerset of frame [frozenset(), frozenset({'a'}), frozenset({'c'}), frozenset({'b'}), frozenset({'a', 'c'}), frozenset({'a',
'b'}), frozenset({'b', 'c'}), frozenset({'a', 'b', 'c'})]
```

Signature of the Student

[YUVRAJ SINGH CHAUHAN]