Problem Statement:

Prepare rules for the all the data sets

1) Try different values of support and confidence. Observe the change in number of rules for different support,confidence values

2) Change the minimum length in apriori algorithm

3) Visulize the obtained rules using different plots

Association Rules:

What goes with what..

If(antecedents) -Then(concequents)

In [1]:
```
import pandas as pd
from mlxtend.frequent_patterns import apriori,association_rules
import matplotlib.pyplot as plt
import seaborn as sns
```

In [2]:
```
movie_data=pd.read_csv('my_movies.csv')
movie_data
```

Out[2]:

	V1	V2	V3	V4	V5	Sixth Sense	Gladiator	LOTR1	Harry Potter1	Patriot	LOTR2	Harry Potter2	LOTR	Braveheart	Green Mile
0	Sixth Sense	LOTR1	Harry Potter1	Green Mile	LOTR2	1	0	1	1	0	1	0	0	0	1
1	Gladiator	Patriot	Braveheart	NaN	NaN	0	1	0	0	1	0	0	0	1	0
2	LOTR1	LOTR2	NaN	NaN	NaN	0	0	1	0	0	1	0	0	0	0
3	Gladiator	Patriot	Sixth Sense	NaN	NaN	1	1	0	0	1	0	0	0	0	0
4	Gladiator	Patriot	Sixth Sense	NaN	NaN	1	1	0	0	1	0	0	0	0	0
5	Gladiator	Patriot	Sixth Sense	NaN	NaN	1	1	0	0	1	0	0	0	0	0
6	Harry Potter1	Harry Potter2	NaN	NaN	NaN	0	0	0	1	0	0	1	0	0	0
7	Gladiator	Patriot	NaN	NaN	NaN	0	1	0	0	1	0	0	0	0	0
8	Gladiator	Patriot	Sixth Sense	NaN	NaN	1	1	0	0	1	0	0	0	0	0
9	Sixth Sense	LOTR	Gladiator	Green Mile	NaN	1	1	0	0	0	0	0	1	0	1

In [3]:
```
movie_data.shape
```

Out[3]:
```
(10, 15)
```

Observation:

As the movie data is in both text and encoded format , i would like to drop first 5 columns

In [4]:
```
new_movie_data =movie_data.drop( labels=['V1','V2','V3','V4','V5'],axis=1)
new_movie_data
```

Out[4]:

	Sixth Sense	Gladiator	LOTR1	Harry Potter1	Patriot	LOTR2	Harry Potter2	LOTR	Braveheart	Green Mile
0	1	0	1	1	0	1	0	0	0	1
1	0	1	0	0	1	0	0	0	1	0
2	0	0	1	0	0	1	0	0	0	0
3	1	1	0	0	1	0	0	0	0	0

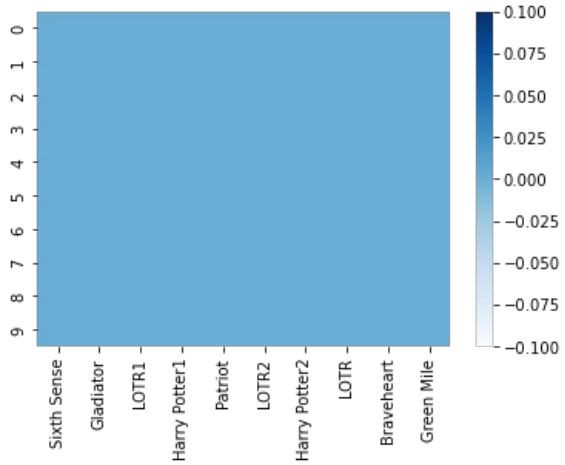
4	1	1	0	0	1	0	0	0	0	0
5	1	1	0	0	1	0	0	0	0	0
6	0	0	0	1	0	0	1	0	0	0
7	0	1	0	0	1	0	0	0	0	0
8	1	1	0	0	1	0	0	0	0	0
9	1	1	0	0	0	0	0	1	0	1

In [5]:
```
new_movie_data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10 entries, 0 to 9
Data columns (total 10 columns):
 #   Column         Non-Null Count  Dtype
---  ------         --------------  -----
 0   Sixth Sense    10 non-null     int64
 1   Gladiator      10 non-null     int64
 2   LOTR1          10 non-null     int64
 3   Harry Potter1  10 non-null     int64
 4   Patriot        10 non-null     int64
 5   LOTR2          10 non-null     int64
 6   Harry Potter2  10 non-null     int64
 7   LOTR           10 non-null     int64
 8   Braveheart     10 non-null     int64
 9   Green Mile     10 non-null     int64
dtypes: int64(10)
memory usage: 928.0 bytes
```

In [6]:
```
sns.heatmap(new_movie_data.isnull(),cmap='Blues')
```

Out[6]:
```
<AxesSubplot:>
```



Data Preparation

NOTE

. Lift- High Lift value indicates both the items are associates strongly . Leverage- A leverage value of 0 indicates independence. Range will be [-1 1] . Conviction- A high conviction value means that the consequent is highly depending on the antecedent and range [0 inf]

In [7]:
```
freq_movie_names1=apriori( df=new_movie_data,min_support=0.20,use_colnames=True)
freq_movie_names1
```

Out[7]:

	support	itemsets
0	0.6	(Sixth Sense)
1	0.7	(Gladiator)
2	0.2	(LOTR1)
3	0.2	(Harry Potter1)

4	0.6	(Patriot)
5	0.2	(LOTR2)
6	0.2	(Green Mile)
7	0.5	(Sixth Sense, Gladiator)
8	0.4	(Patriot, Sixth Sense)
9	0.2	(Sixth Sense, Green Mile)
10	0.6	(Patriot, Gladiator)
11	0.2	(LOTR2, LOTR1)
12	0.4	(Patriot, Sixth Sense, Gladiator)

In [8]:

```
#  confidence = 60%

rules1=association_rules( df=freq_movie_names1,metric='lift',min_threshold=0.6)
rules1
```

Out[8]:

	antecedents	consequents	antecedent support	consequent support	support	confidence	lift	leverage	conviction
0	(Sixth Sense)	(Gladiator)	0.6	0.7	0.5	0.833333	1.190476	0.08	1.8
1	(Gladiator)	(Sixth Sense)	0.7	0.6	0.5	0.714286	1.190476	0.08	1.4
2	(Patriot)	(Sixth Sense)	0.6	0.6	0.4	0.666667	1.111111	0.04	1.2
3	(Sixth Sense)	(Patriot)	0.6	0.6	0.4	0.666667	1.111111	0.04	1.2
4	(Sixth Sense)	(Green Mile)	0.6	0.2	0.2	0.333333	1.666667	0.08	1.2
5	(Green Mile)	(Sixth Sense)	0.2	0.6	0.2	1.000000	1.666667	0.08	inf
6	(Patriot)	(Gladiator)	0.6	0.7	0.6	1.000000	1.428571	0.18	inf
7	(Gladiator)	(Patriot)	0.7	0.6	0.6	0.857143	1.428571	0.18	2.8
8	(LOTR2)	(LOTR1)	0.2	0.2	0.2	1.000000	5.000000	0.16	inf
9	(LOTR1)	(LOTR2)	0.2	0.2	0.2	1.000000	5.000000	0.16	inf
10	(Patriot, Sixth Sense)	(Gladiator)	0.4	0.7	0.4	1.000000	1.428571	0.12	inf
11	(Patriot, Gladiator)	(Sixth Sense)	0.6	0.6	0.4	0.666667	1.111111	0.04	1.2
12	(Sixth Sense, Gladiator)	(Patriot)	0.5	0.6	0.4	0.800000	1.333333	0.10	2.0
13	(Patriot)	(Sixth Sense, Gladiator)	0.6	0.5	0.4	0.666667	1.333333	0.10	1.5
14	(Sixth Sense)	(Patriot, Gladiator)	0.6	0.6	0.4	0.666667	1.111111	0.04	1.2
15	(Gladiator)	(Patriot, Sixth Sense)	0.7	0.4	0.4	0.571429	1.428571	0.12	1.4

In [9]:

```
rules1.sort_values('lift',ascending= False)
```

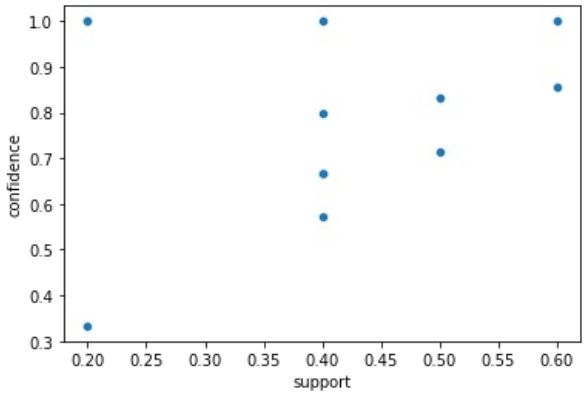
Out[9]:

	antecedents	consequents	antecedent support	consequent support	support	confidence	lift	leverage	conviction
8	(LOTR2)	(LOTR1)	0.2	0.2	0.2	1.000000	5.000000	0.16	inf
9	(LOTR1)	(LOTR2)	0.2	0.2	0.2	1.000000	5.000000	0.16	inf
4	(Sixth Sense)	(Green Mile)	0.6	0.2	0.2	0.333333	1.666667	0.08	1.2
5	(Green Mile)	(Sixth Sense)	0.2	0.6	0.2	1.000000	1.666667	0.08	inf
7	(Gladiator)	(Patriot)	0.7	0.6	0.6	0.857143	1.428571	0.18	2.8
6	(Patriot)	(Gladiator)	0.6	0.7	0.6	1.000000	1.428571	0.18	inf
10	(Patriot, Sixth Sense)	(Gladiator)	0.4	0.7	0.4	1.000000	1.428571	0.12	inf
15	(Gladiator)	(Patriot, Sixth Sense)	0.7	0.4	0.4	0.571429	1.428571	0.12	1.4
12	(Sixth Sense, Gladiator)	(Patriot)	0.5	0.6	0.4	0.800000	1.333333	0.10	2.0
13	(Patriot)	(Sixth Sense, Gladiator)	0.6	0.5	0.4	0.666667	1.333333	0.10	1.5
0	(Sixth Sense)	(Gladiator)	0.6	0.7	0.5	0.833333	1.190476	0.08	1.8
1	(Gladiator)	(Sixth Sense)	0.7	0.6	0.5	0.714286	1.190476	0.08	1.4
2	(Patriot)	(Sixth Sense)	0.6	0.6	0.4	0.666667	1.111111	0.04	1.2
3	(Sixth Sense)	(Patriot)	0.6	0.6	0.4	0.666667	1.111111	0.04	1.2
11	(Patriot, Gladiator)	(Sixth Sense)	0.6	0.6	0.4	0.666667	1.111111	0.04	1.2

14	(Sixth Sense)	(Patriot, Gladiator)	0.6	0.6	0.4	0.666667	1.111111	0.04	1.2

In [10]:
```
sns.scatterplot( x='support',y='confidence', data= rules1)
```

Out[10]:
```
<AxesSubplot:xlabel='support', ylabel='confidence'>
```



Min_support = 10%|

In [11]:
```
freq_movie_names2 = apriori( df=new_movie_data, min_support=0.10,use_colnames=True)
freq_movie_names2
```

Out[11]:

	support	itemsets
0	0.6	(Sixth Sense)
1	0.7	(Gladiator)
2	0.2	(LOTR1)
3	0.2	(Harry Potter1)
4	0.6	(Patriot)
5	0.2	(LOTR2)
6	0.1	(Harry Potter2)
7	0.1	(LOTR)
8	0.1	(Braveheart)
9	0.2	(Green Mile)
10	0.5	(Sixth Sense, Gladiator)
11	0.1	(Sixth Sense, LOTR1)
12	0.1	(Sixth Sense, Harry Potter1)
13	0.4	(Patriot, Sixth Sense)
14	0.1	(Sixth Sense, LOTR2)
15	0.1	(Sixth Sense, LOTR)
16	0.2	(Sixth Sense, Green Mile)
17	0.6	(Patriot, Gladiator)
18	0.1	(LOTR, Gladiator)
19	0.1	(Braveheart, Gladiator)
20	0.1	(Green Mile, Gladiator)
21	0.1	(LOTR1, Harry Potter1)
22	0.2	(LOTR2, LOTR1)
23	0.1	(Green Mile, LOTR1)
24	0.1	(LOTR2, Harry Potter1)
25	0.1	(Harry Potter2, Harry Potter1)
26	0.1	(Green Mile, Harry Potter1)
27	0.1	(Patriot, Braveheart)
28	0.1	(LOTR2, Green Mile)
29	0.1	(LOTR, Green Mile)

30	0.4	(Patriot, Sixth Sense, Gladiator)
31	0.1	(Sixth Sense, LOTR, Gladiator)
32	0.1	(Sixth Sense, Green Mile, Gladiator)
33	0.1	(Sixth Sense, LOTR1, Harry Potter1)
34	0.1	(Sixth Sense, LOTR2, LOTR1)
35	0.1	(Sixth Sense, Green Mile, LOTR1)
36	0.1	(Sixth Sense, LOTR2, Harry Potter1)
37	0.1	(Sixth Sense, Green Mile, Harry Potter1)
38	0.1	(Sixth Sense, LOTR2, Green Mile)
39	0.1	(Sixth Sense, Green Mile, LOTR)
40	0.1	(Patriot, Braveheart, Gladiator)
41	0.1	(LOTR, Green Mile, Gladiator)
42	0.1	(LOTR2, LOTR1, Harry Potter1)
43	0.1	(Green Mile, LOTR1, Harry Potter1)
44	0.1	(LOTR2, Green Mile, LOTR1)
45	0.1	(LOTR2, Green Mile, Harry Potter1)
46	0.1	(Sixth Sense, Green Mile, LOTR, Gladiator)
47	0.1	(Sixth Sense, LOTR2, LOTR1, Harry Potter1)
48	0.1	(Sixth Sense, Green Mile, LOTR1, Harry Potter1)
49	0.1	(Sixth Sense, LOTR2, Green Mile, LOTR1)
50	0.1	(Sixth Sense, LOTR2, Green Mile, Harry Potter1)
51	0.1	(LOTR2, Green Mile, LOTR1, Harry Potter1)
52	0.1	(Sixth Sense, Green Mile, LOTR2, Harry Potter1...

confidence = 70%

In [12]:
```
rules2 = association_rules(df= freq_movie_names2,metric='lift', min_threshold=0.7)
rules2
```

Out[12]:

	antecedents	consequents	antecedent support	consequent support	support	confidence	lift	leverage	conviction
0	(Sixth Sense)	(Gladiator)	0.6	0.7	0.5	0.833333	1.190476	0.08	1.80
1	(Gladiator)	(Sixth Sense)	0.7	0.6	0.5	0.714286	1.190476	0.08	1.40
2	(Sixth Sense)	(LOTR1)	0.6	0.2	0.1	0.166667	0.833333	-0.02	0.96
3	(LOTR1)	(Sixth Sense)	0.2	0.6	0.1	0.500000	0.833333	-0.02	0.80
4	(Sixth Sense)	(Harry Potter1)	0.6	0.2	0.1	0.166667	0.833333	-0.02	0.96
...	...	...	...	...	...	...	...	...	...
245	(Sixth Sense)	(LOTR2, Green Mile, LOTR1, Harry Potter1)	0.6	0.1	0.1	0.166667	1.666667	0.04	1.08
246	(Green Mile)	(Sixth Sense, LOTR2, LOTR1, Harry Potter1)	0.2	0.1	0.1	0.500000	5.000000	0.08	1.80
247	(LOTR2)	(Sixth Sense, Green Mile, LOTR1, Harry Potter1)	0.2	0.1	0.1	0.500000	5.000000	0.08	1.80
248	(Harry Potter1)	(Sixth Sense, LOTR2, Green Mile, LOTR1)	0.2	0.1	0.1	0.500000	5.000000	0.08	1.80
249	(LOTR1)	(Sixth Sense, LOTR2, Green Mile, Harry Potter1)	0.2	0.1	0.1	0.500000	5.000000	0.08	1.80

250 rows × 9 columns

In [13]:
```
rules2[rules2.lift>1]
```

Out[13]:

	antecedents	consequents	antecedent support	consequent support	support	confidence	lift	leverage	conviction
	(Sixth								

0	Sense)	(Gladiator)	0.6	0.7	0.5	0.833333	1.190476	0.08	1.80
1	(Gladiator)	(Sixth Sense)	0.7	0.6	0.5	0.714286	1.190476	0.08	1.40
6	(Patriot)	(Sixth Sense)	0.6	0.6	0.4	0.666667	1.111111	0.04	1.20
7	(Sixth Sense)	(Patriot)	0.6	0.6	0.4	0.666667	1.111111	0.04	1.20
10	(Sixth Sense)	(LOTR)	0.6	0.1	0.1	0.166667	1.666667	0.04	1.08
...	...	...	...	...	...	...	...	...	...
245	(Sixth Sense)	(LOTR2, Green Mile, LOTR1, Harry Potter1)	0.6	0.1	0.1	0.166667	1.666667	0.04	1.08
246	(Green Mile)	(Sixth Sense, LOTR2, LOTR1, Harry Potter1)	0.2	0.1	0.1	0.500000	5.000000	0.08	1.80
247	(LOTR2)	(Sixth Sense, Green Mile, LOTR1, Harry Potter1)	0.2	0.1	0.1	0.500000	5.000000	0.08	1.80
248	(Harry Potter1)	(Sixth Sense, LOTR2, Green Mile, LOTR1)	0.2	0.1	0.1	0.500000	5.000000	0.08	1.80
249	(LOTR1)	(Sixth Sense, LOTR2, Green Mile, Harry Potter1)	0.2	0.1	0.1	0.500000	5.000000	0.08	1.80

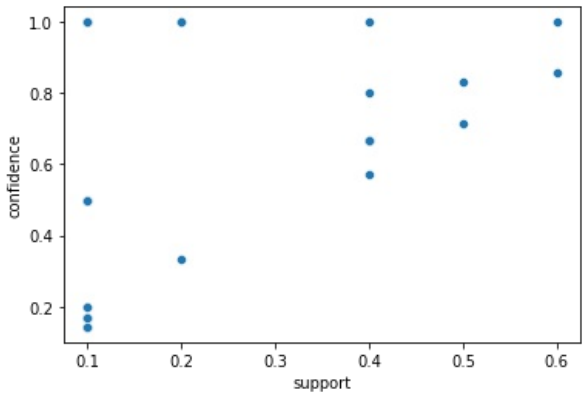
236 rows × 9 columns

Inference:

We can observe that out of 250 frequent items we got 236 items with high association becoz of the lift value>1

In [14]:
```
sns.scatterplot(x='support',y='confidence', data= rules2)
```

Out[14]:
```
<AxesSubplot:xlabel='support', ylabel='confidence'>
```



Min_support = 5%

In [15]:
```
freq_movie_names3 = apriori(df=new_movie_data,min_support=0.05,use_colnames=True)
freq_movie_names3
```

Out[15]:

	support	itemsets
0	0.6	(Sixth Sense)
1	0.7	(Gladiator)
2	0.2	(LOTR1)
3	0.2	(Harry Potter1)
4	0.6	(Patriot)
5	0.2	(LOTR2)
6	0.1	(Harry Potter2)
7	0.1	(LOTR)
8	0.1	(Braveheart)
9	0.2	(Green Mile)
10	0.5	(Sixth Sense, Gladiator)

11	0.1	(Sixth Sense, LOTR1)
12	0.1	(Sixth Sense, Harry Potter1)
13	0.4	(Patriot, Sixth Sense)
14	0.1	(Sixth Sense, LOTR2)
15	0.1	(Sixth Sense, LOTR)
16	0.2	(Sixth Sense, Green Mile)
17	0.6	(Patriot, Gladiator)
18	0.1	(LOTR, Gladiator)
19	0.1	(Braveheart, Gladiator)
20	0.1	(Green Mile, Gladiator)
21	0.1	(LOTR1, Harry Potter1)
22	0.2	(LOTR2, LOTR1)
23	0.1	(Green Mile, LOTR1)
24	0.1	(LOTR2, Harry Potter1)
25	0.1	(Harry Potter2, Harry Potter1)
26	0.1	(Green Mile, Harry Potter1)
27	0.1	(Patriot, Braveheart)
28	0.1	(LOTR2, Green Mile)
29	0.1	(LOTR, Green Mile)
30	0.4	(Patriot, Sixth Sense, Gladiator)
31	0.1	(Sixth Sense, LOTR, Gladiator)
32	0.1	(Sixth Sense, Green Mile, Gladiator)
33	0.1	(Sixth Sense, LOTR1, Harry Potter1)
34	0.1	(Sixth Sense, LOTR2, LOTR1)
35	0.1	(Sixth Sense, Green Mile, LOTR1)
36	0.1	(Sixth Sense, LOTR2, Harry Potter1)
37	0.1	(Sixth Sense, Green Mile, Harry Potter1)
38	0.1	(Sixth Sense, LOTR2, Green Mile)
39	0.1	(Sixth Sense, Green Mile, LOTR)
40	0.1	(Patriot, Braveheart, Gladiator)
41	0.1	(LOTR, Green Mile, Gladiator)
42	0.1	(LOTR2, LOTR1, Harry Potter1)
43	0.1	(Green Mile, LOTR1, Harry Potter1)
44	0.1	(LOTR2, Green Mile, LOTR1)
45	0.1	(LOTR2, Green Mile, Harry Potter1)
46	0.1	(Sixth Sense, Green Mile, LOTR, Gladiator)
47	0.1	(Sixth Sense, LOTR2, LOTR1, Harry Potter1)
48	0.1	(Sixth Sense, Green Mile, LOTR1, Harry Potter1)
49	0.1	(Sixth Sense, LOTR2, Green Mile, LOTR1)
50	0.1	(Sixth Sense, LOTR2, Green Mile, Harry Potter1)
51	0.1	(LOTR2, Green Mile, LOTR1, Harry Potter1)
52	0.1	(Sixth Sense, Green Mile, LOTR2, Harry Potter1...

In [16]:

```
# confidence 90
rules3 = association_rules(df= freq_movie_names3,metric= 'lift',min_threshold=0.9)
rules3
```

Out[16]:

	antecedents	consequents	antecedent support	consequent support	support	confidence	lift	leverage	conviction
0	(Sixth Sense)	(Gladiator)	0.6	0.7	0.5	0.833333	1.190476	0.08	1.80
1	(Gladiator)	(Sixth Sense)	0.7	0.6	0.5	0.714286	1.190476	0.08	1.40
2	(Patriot)	(Sixth Sense)	0.6	0.6	0.4	0.666667	1.111111	0.04	1.20
3	(Sixth Sense)	(Patriot)	0.6	0.6	0.4	0.666667	1.111111	0.04	1.20
	(Sixth								

4	Sense)	(LOTR)	0.6	0.1	0.1	0.166667	1.666667	0.04	1.08
...	...	...	...	...	...	...	...	...	...
233	(Sixth Sense)	(LOTR2, Green Mile, LOTR1, Harry Potter1)	0.6	0.1	0.1	0.166667	1.666667	0.04	1.08
234	(Green Mile)	(Sixth Sense, LOTR2, LOTR1, Harry Potter1)	0.2	0.1	0.1	0.500000	5.000000	0.08	1.80
235	(LOTR2)	(Sixth Sense, Green Mile, LOTR1, Harry Potter1)	0.2	0.1	0.1	0.500000	5.000000	0.08	1.80
236	(Harry Potter1)	(Sixth Sense, LOTR2, Green Mile, LOTR1)	0.2	0.1	0.1	0.500000	5.000000	0.08	1.80
237	(LOTR1)	(Sixth Sense, LOTR2, Green Mile, Harry Potter1)	0.2	0.1	0.1	0.500000	5.000000	0.08	1.80

238 rows × 9 columns

In [17]:
```
rules3[rules3.lift>1]
```

Out[17]:

	antecedents	consequents	antecedent support	consequent support	support	confidence	lift	leverage	conviction
0	(Sixth Sense)	(Gladiator)	0.6	0.7	0.5	0.833333	1.190476	0.08	1.80
1	(Gladiator)	(Sixth Sense)	0.7	0.6	0.5	0.714286	1.190476	0.08	1.40
2	(Patriot)	(Sixth Sense)	0.6	0.6	0.4	0.666667	1.111111	0.04	1.20
3	(Sixth Sense)	(Patriot)	0.6	0.6	0.4	0.666667	1.111111	0.04	1.20
4	(Sixth Sense)	(LOTR)	0.6	0.1	0.1	0.166667	1.666667	0.04	1.08
...	...	...	...	...	...	...	...	...	...
233	(Sixth Sense)	(LOTR2, Green Mile, LOTR1, Harry Potter1)	0.6	0.1	0.1	0.166667	1.666667	0.04	1.08
234	(Green Mile)	(Sixth Sense, LOTR2, LOTR1, Harry Potter1)	0.2	0.1	0.1	0.500000	5.000000	0.08	1.80
235	(LOTR2)	(Sixth Sense, Green Mile, LOTR1, Harry Potter1)	0.2	0.1	0.1	0.500000	5.000000	0.08	1.80
236	(Harry Potter1)	(Sixth Sense, LOTR2, Green Mile, LOTR1)	0.2	0.1	0.1	0.500000	5.000000	0.08	1.80
237	(LOTR1)	(Sixth Sense, LOTR2, Green Mile, Harry Potter1)	0.2	0.1	0.1	0.500000	5.000000	0.08	1.80

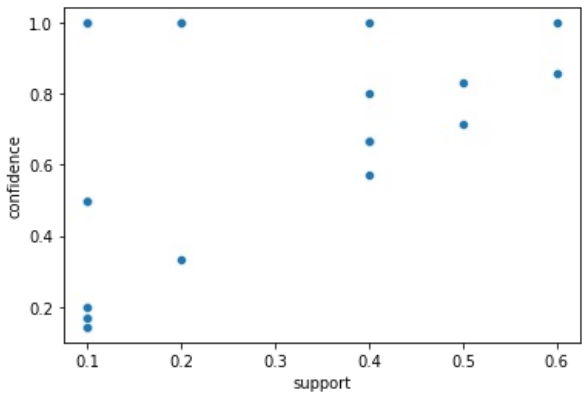
236 rows × 9 columns

Inference:

Two observations has been removed because of the lift value<1

In [18]:
```
sns.scatterplot(x= 'support', y='confidence',data=rules3)
```

Out[18]:
```
<AxesSubplot:xlabel='support', ylabel='confidence'>
```



THE END

THE END

In [ ]: