In [2]:

```
import pandas as pd
df=pd.read_csv("Market_Basket_Optimisation.csv",header=None)
df
```

Out[2]:

	0	1	2	3	4	5	6	7	8	9
0	shrimp	almonds	avocado	vegetables mix	green grapes	whole weat flour	yams	cottage cheese	energy drink	tomato juice
1	burgers	meatballs	eggs	NaN	NaN	NaN	NaN	NaN	NaN	NaN
2	chutney	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
3	turkey	avocado	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
4	mineral water	milk	energy bar	whole wheat rice	green tea	NaN	NaN	NaN	NaN	NaN
...	...	...	...	...	...	...	...	...	...	...
7496	butter	light mayo	fresh bread	NaN	NaN	NaN	NaN	NaN	NaN	NaN
7497	burgers	frozen vegetables	eggs	french fries	magazines	green tea	NaN	NaN	NaN	NaN
7498	chicken	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
7499	escalope	green tea	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
7500	eggs	frozen smoothie	yogurt cake	low fat yogurt	NaN	NaN	NaN	NaN	NaN	NaN

7501 rows × 20 columns

In [3]:
```
df.isnull()
```

Out[3]:

	0	1	2	3	4	5	6	7	8	9	10	11	12	13
0	False	False	False	False	False	False	False	False	False	False	False	False	False	False
1	False	False	False	True	True	True	True	True	True	True	True	True	True	True
2	False	True	True	True	True	True	True	True	True	True	True	True	True	True
3	False	False	True	True	True	True	True	True	True	True	True	True	True	True
4	False	False	False	False	False	True	True	True	True	True	True	True	True	True
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7496	False	False	False	True	True	True	True	True	True	True	True	True	True	True
7497	False	False	False	False	False	False	True	True	True	True	True	True	True	True
7498	False	True	True	True	True	True	True	True	True	True	True	True	True	True
7499	False	False	True	True	True	True	True	True	True	True	True	True	True	True
7500	False	False	False	False	True	True	True	True	True	True	True	True	True	True

7501 rows × 20 columns

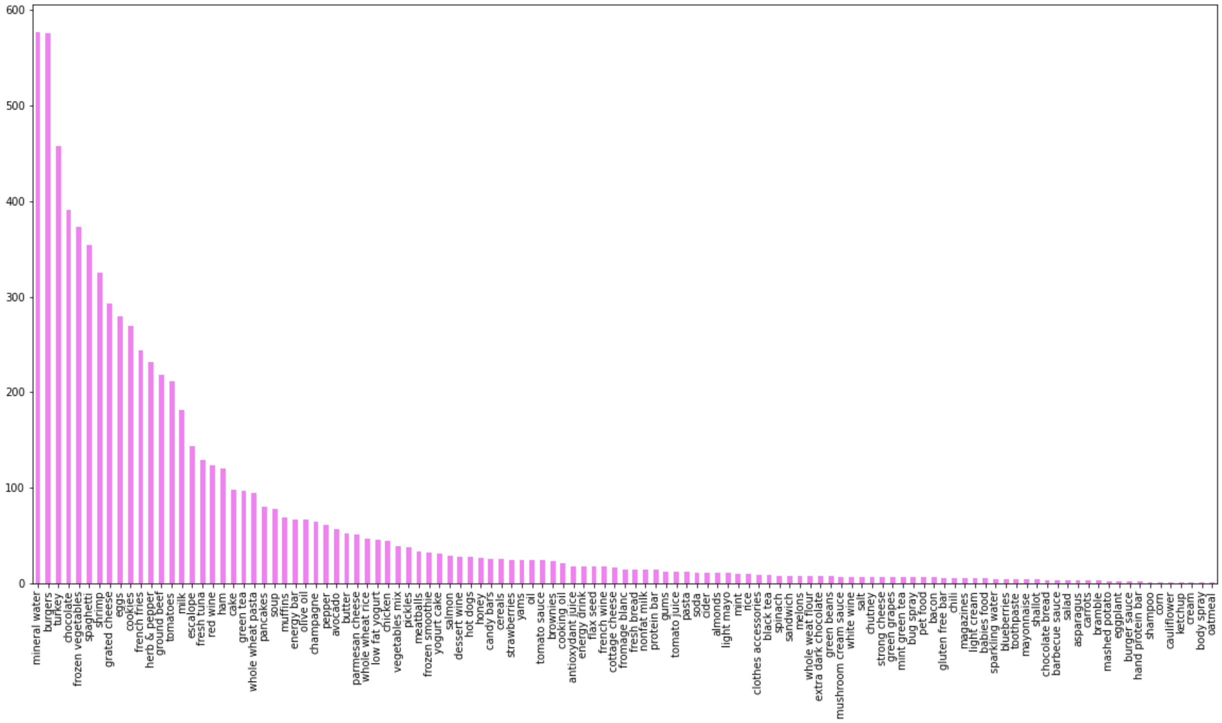
In [4]:
```
df.isnull().sum()
```

Out[4]:
```
0        0
1     1754
2     3112
3     4156
4     4972
5     5637
6     6132
7     6520
8     6847
9     7106
10    7245
11    7347
12    7414
13    7454
14    7476
15    7493
16    7497
17    7497
18    7498
19    7500
dtype: int64
```

In [5]:
```
df.values.tolist()
```

Out[5]:
```
[['shrimp',
  'almonds',
  'avocado',
  'vegetables mix',
  'green grapes',
  'whole weat flour',
  'yams',
  'cottage cheese',
  'energy drink',
  'tomato juice',
  'low fat yogurt',
  'green tea',
  'honey',
  'salad',
  'mineral water',
  'salmon',
  'antioxydant juice',
  'frozen smoothie',
  'spinach',
```

In [7]:
```
import matplotlib.pyplot as plt
# import numpy as np
# c = plt.cm.rainbow(np.linspace(0, 1, 40))
df[0].value_counts().plot.bar(color = 'violet', figsize=(20,10))
plt.show()
```



In [29]:

```
t=[]
for i in range (len(df)) :
    t.append([str(df.values[i,j]) for j in range(20) if str(df.values[i,j])!='nan
t
```

Out[29]:

```
[['shrimp',
  'almonds',
  'avocado',
  'vegetables mix',
  'green grapes',
  'whole weat flour',
  'yams',
  'cottage cheese',
  'energy drink',
  'tomato juice',
  'low fat yogurt',
  'green tea',
  'honey',
  'salad',
  'mineral water',
  'salmon',
  'antioxydant juice',
  'frozen smoothie',
  'spinach',
```

In [34]:

```
from apyori import apriori
rule = apriori(transactions = t, min_support = 0.003, min_confidence = 0.2, min_l
result=list(rule)
result
```

Out[34]:

```
[RelationRecord(items=frozenset({'light cream', 'chicken'}), support=0.00453
2728969470737, ordered_statistics=[OrderedStatistic(items_base=frozenset({'l
ight cream'}), items_add=frozenset({'chicken'}), confidence=0.29059829059829
057, lift=4.84395061728395)]),
 RelationRecord(items=frozenset({'mushroom cream sauce', 'escalope'}), suppo
rt=0.005732568990801226, ordered_statistics=[OrderedStatistic(items_base=fro
zenset({'mushroom cream sauce'}), items_add=frozenset({'escalope'}), confide
nce=0.3006993006993007, lift=3.790832696715049)]),
 RelationRecord(items=frozenset({'pasta', 'escalope'}), support=0.0058658845
48726837, ordered_statistics=[OrderedStatistic(items_base=frozenset({'past
a'}), items_add=frozenset({'escalope'}), confidence=0.3728813559322034, lift
=4.700811850163794)]),
 RelationRecord(items=frozenset({'fromage blanc', 'honey'}), support=0.00333
2888948140248, ordered_statistics=[OrderedStatistic(items_base=frozenset({'f
romage blanc'}), items_add=frozenset({'honey'}), confidence=0.24509803921568
63, lift=5.164270764485569)]),
 RelationRecord(items=frozenset({'ground beef', 'herb & pepper'}), support=
0.015997866951073192, ordered_statistics=[OrderedStatistic(items_base=frozen
set({'herb & pepper'}), items_add=frozenset({'ground beef'}), confidence=0.3
```

In [35]:
```
for i in range(len(result)):
    print(result[i][0])
```

```
frozenset({'light cream', 'chicken'})
frozenset({'mushroom cream sauce', 'escalope'})
frozenset({'pasta', 'escalope'})
frozenset({'fromage blanc', 'honey'})
frozenset({'ground beef', 'herb & pepper'})
frozenset({'ground beef', 'tomato sauce'})
frozenset({'light cream', 'olive oil'})
frozenset({'whole wheat pasta', 'olive oil'})
frozenset({'pasta', 'shrimp'})
frozenset({'avocado', 'milk', 'spaghetti'})
frozenset({'cake', 'burgers', 'milk'})
frozenset({'chocolate', 'burgers', 'turkey'})
frozenset({'burgers', 'milk', 'turkey'})
frozenset({'cake', 'tomatoes', 'frozen vegetables'})
frozenset({'ground beef', 'cereals', 'spaghetti'})
frozenset({'ground beef', 'chicken', 'milk'})
frozenset({'olive oil', 'chicken', 'milk'})
frozenset({'chicken', 'olive oil', 'spaghetti'})
frozenset({'chocolate', 'frozen vegetables', 'shrimp'})
frozenset({'ground beef', 'chocolate', 'herb & pepper'})
frozenset({'chocolate', 'soup', 'milk'})
frozenset({'ground beef', 'cooking oil', 'spaghetti'})
frozenset({'ground beef', 'eggs', 'herb & pepper'})
frozenset({'eggs', 'spaghetti', 'red wine'})
frozenset({'ground beef', 'french fries', 'herb & pepper'})
frozenset({'tomatoes', 'frozen vegetables', 'green tea'})
frozenset({'ground beef', 'frozen vegetables', 'spaghetti'})
frozenset({'olive oil', 'frozen vegetables', 'milk'})
frozenset({'soup', 'frozen vegetables', 'milk'})
frozenset({'tomatoes', 'frozen vegetables', 'milk'})
frozenset({'frozen vegetables', 'shrimp', 'mineral water'})
frozenset({'frozen vegetables', 'olive oil', 'spaghetti'})
frozenset({'frozen vegetables', 'shrimp', 'spaghetti'})
frozenset({'tomatoes', 'frozen vegetables', 'shrimp'})
frozenset({'tomatoes', 'frozen vegetables', 'spaghetti'})
frozenset({'ground beef', 'grated cheese', 'spaghetti'})
frozenset({'ground beef', 'tomatoes', 'green tea'})
frozenset({'ground beef', 'milk', 'herb & pepper'})
frozenset({'ground beef', 'mineral water', 'herb & pepper'})
frozenset({'ground beef', 'spaghetti', 'herb & pepper'})
frozenset({'ground beef', 'olive oil', 'milk'})
frozenset({'ground beef', 'soup', 'milk'})
frozenset({'ground beef', 'pepper', 'spaghetti'})
frozenset({'ground beef', 'shrimp', 'spaghetti'})
frozenset({'ground beef', 'tomato sauce', 'spaghetti'})
frozenset({'light cream', 'spaghetti', 'mineral water'})
frozenset({'olive oil', 'shrimp', 'milk'})
frozenset({'soup', 'olive oil', 'milk'})
frozenset({'olive oil', 'milk', 'spaghetti'})
frozenset({'soup', 'tomatoes', 'milk'})
frozenset({'whole wheat pasta', 'milk', 'spaghetti'})
frozenset({'soup', 'olive oil', 'mineral water'})
frozenset({'whole wheat pasta', 'olive oil', 'mineral water'})
frozenset({'pancakes', 'olive oil', 'spaghetti'})
frozenset({'tomatoes', 'olive oil', 'spaghetti'})
frozenset({'tomatoes', 'whole wheat rice', 'spaghetti'})
frozenset({'ground beef', 'chocolate', 'eggs', 'mineral water'})
frozenset({'ground beef', 'chocolate', 'frozen vegetables', 'mineral water'})
frozenset({'ground beef', 'chocolate', 'frozen vegetables', 'spaghetti'})
frozenset({'chocolate', 'frozen vegetables', 'milk', 'mineral water'})
frozenset({'chocolate', 'frozen vegetables', 'milk', 'spaghetti'})
frozenset({'chocolate', 'frozen vegetables', 'shrimp', 'mineral water'})
frozenset({'chocolate', 'spaghetti', 'olive oil', 'mineral water'})
frozenset({'chocolate', 'spaghetti', 'shrimp', 'mineral water'})
frozenset({'eggs', 'frozen vegetables', 'milk', 'mineral water'})
frozenset({'frozen smoothie', 'spaghetti', 'milk', 'mineral water'})
frozenset({'ground beef', 'frozen vegetables', 'milk', 'mineral water'})
frozenset({'ground beef', 'frozen vegetables', 'milk', 'spaghetti'})
frozenset({'ground beef', 'frozen vegetables', 'spaghetti', 'mineral water'})
frozenset({'olive oil', 'frozen vegetables', 'milk', 'mineral water'})
frozenset({'soup', 'frozen vegetables', 'milk', 'mineral water'})
frozenset({'spaghetti', 'frozen vegetables', 'milk', 'mineral water'})
frozenset({'spaghetti', 'frozen vegetables', 'shrimp', 'mineral water'})
frozenset({'tomatoes', 'frozen vegetables', 'spaghetti', 'mineral water'})
frozenset({'ground beef', 'spaghetti', 'milk', 'mineral water'})
frozenset({'ground beef', 'spaghetti', 'olive oil', 'mineral water'})
frozenset({'ground beef', 'pancakes', 'spaghetti', 'mineral water'})
frozenset({'ground beef', 'tomatoes', 'spaghetti', 'mineral water'})
frozenset({'olive oil', 'spaghetti', 'milk', 'mineral water'})
frozenset({'tomatoes', 'spaghetti', 'milk', 'mineral water'})
```

In [40]:
```python
for item in result:

    # first index of the inner list
    # Contains base item and add item
    pair = item[0]
    items = [x for x in pair]
    print("Rule: " + items[0] + " -> " + items[1])

    #second index of the inner list
    print("Support: " + str(item[1]))

    #third index of the list located at 0th
    #of the third index of the inner list

    print("Confidence: " + str(item[2][0][2]))
    print("Lift: " + str(item[2][0][3]))
    print("______________________________________________________________")
```

```
Rule: light cream -> chicken
Support: 0.004532728969470737
Confidence: 0.29059829059829057
Lift: 4.84395061728395
______________________________________________________________
Rule: mushroom cream sauce -> escalope
Support: 0.005732568990801226
Confidence: 0.3006993006993007
Lift: 3.790832696715049
______________________________________________________________
Rule: pasta -> escalope
Support: 0.005865884548726837
Confidence: 0.3728813559322034
Lift: 4.700811850163794
______________________________________________________________
Rule: fromage blanc -> honey
Support: 0.003332888948140248
Confidence: 0.2450980392156863
Lift: 5.164270764485569
```

In [42]:
```
ls=[]
for item in result:
    pair=item[0]
    items=[x for x in pair]
    ls.append([str(items[0]+"->"+items[1]),str(item[1]),str(item[2][0][2]),str(it
ls
```

Out[42]:
```
[['light cream->chicken',
  '0.004532728969470737',
  '0.29059829059829057',
  '4.84395061728395'],
 ['mushroom cream sauce->escalope',
  '0.005732568990801226',
  '0.3006993006993007',
  '3.790832696715049'],
 ['pasta->escalope',
  '0.005865884548726837',
  '0.3728813559322034',
  '4.700811850163794'],
 ['fromage blanc->honey',
  '0.003332888948140248',
  '0.2450980392156863',
  '5.164270764485569'],
 ['ground beef->herb & pepper',
  '0.015997866951073192',
  '0.3234501347708895',
```

In [43]:
```
df1=pd.DataFrame(ls,columns=['Rules','Support','Confidence','Lift'])
df1
```

Out[43]:

	Rules	Support	Confidence	Lift
0	light cream->chicken	0.004532728969470737	0.29059829059829057	4.84395061728395
1	mushroom cream sauce->escalope	0.005732568990801226	0.3006993006993007	3.790832696715049
2	pasta->escalope	0.005865884548726837	0.3728813559322034	4.700811850163794
3	fromage blanc->honey	0.003332888948140248	0.2450980392156863	5.164270764485569
4	ground beef->herb & pepper	0.015997866951073192	0.3234501347708895	3.2919938411349285
...	...	...	...	...
75	ground beef->spaghetti	0.0030662578322890282	0.2169811320754717	3.63298096361186
76	ground beef->pancakes	0.0030662578322890282	0.21100917431192662	3.532990661861075
77	ground beef->tomatoes	0.0030662578322890282	0.26136363636363635	4.3760907061688314
78	olive oil->spaghetti	0.003332888948140248	0.211864406779661	3.216993755575379
79	tomatoes->spaghetti	0.003332888948140248	0.2380952380952381	3.9865008503401365

80 rows × 4 columns

In [44]:
```
df1.sort_values(by=['Support'],ascending=False)
```

Out[44]:

	Rules	Support	Confidence	Lift
4	ground beef->herb & pepper	0.015997866951073192	0.3234501347708895	3.2919938411349285
26	ground beef->frozen vegetables	0.008665511265164644	0.31100478468899523	3.165328208890303
7	whole wheat pasta->olive oil	0.007998933475536596	0.2714932126696833	4.122410097642296
30	frozen vegetables->shrimp	0.007199040127982935	0.30508474576271183	3.200616332819722
48	olive oil->milk	0.007199040127982935	0.20300751879699247	3.0825089038385434
...	...	...	...	...
67	ground beef->frozen vegetables	0.0030662578322890282	0.5348837209302326	3.0721001460165964
44	ground beef->tomato sauce	0.0030662578322890282	0.2169811320754717	5.535970992170453
49	soup->tomatoes	0.0030662578322890282	0.21904761904761905	4.335293378565146
58	ground beef->chocolate	0.0030662578322890282	0.5348837209302326	3.0721001460165964
11	chocolate->burgers	0.0030662578322890282	0.27058823529411763	3.1034898363014927

80 rows × 4 columns

In [45]:
```
df1.sort_values(by=['Confidence'],ascending=False)
```

Out[45]:

	Rules	Support	Confidence	Lift
14	ground beef->cereals	0.0030662578322890282	0.6764705882352942	3.8853031258445188
54	tomatoes->olive oil	0.004399413411545127	0.6111111111111112	3.5099115194827295
21	ground beef->cooking oil	0.004799360085321957	0.5714285714285714	3.2819951870487856
67	ground beef->frozen vegetables	0.0030662578322890282	0.5348837209302326	3.0721001460165964
58	ground beef->chocolate	0.0030662578322890282	0.5348837209302326	3.0721001460165964
...	...	...	...	...
17	chicken->olive oil	0.0034662045060658577	0.20155038759689922	3.0603835169318647
53	pancakes->olive oil	0.005065991201173177	0.20105820105820105	3.0529100529100526
56	ground beef->chocolate	0.003999466737768298	0.20000000000000004	3.7979746835443047
74	ground beef->spaghetti	0.004399413411545127	0.2	3.3486607142857148
72	spaghetti->frozen vegetables	0.003332888948140248	0.2	3.3486607142857148

80 rows × 4 columns

```
In [46]: df1.sort_values(by=['Lift'],ascending=False)
```

```
Out[46]:
                          Rules               Support          Confidence                Lift
     70     soup->frozen vegetables  0.0030662578322890282  0.38333333333333333  7.987175925925926
     69  olive oil->frozen vegetables   0.003332888948140248  0.29411764705882354   6.12826797385621
     52  whole wheat pasta->olive oil  0.0038661511798426876  0.40277777777777778  6.115862573099416
     44  ground beef->tomato sauce  0.0030662578322890282   0.2169811320754717  5.535970992170453
      3       fromage blanc->honey   0.003332888948140248   0.2450980392156863  5.164270764485569
    ...                         ...                    ...                  ...                ...
     23            eggs->spaghetti  0.0037328356219170776   0.5283018867924528  3.0342974370828397
     36       ground beef->tomatoes  0.0030662578322890282   0.2072072072072072  3.0297490472929067
     71  spaghetti->frozen vegetables   0.004532728969470737  0.28813559322033894  3.0228043143297376
     32     frozen vegetables->shrimp   0.005999200106652446  0.21531100478468898  3.0131489680782684
     43          ground beef->shrimp   0.005999200106652446   0.5232558139534884   3.005315360233627

80 rows × 4 columns
```

```
In [ ]:
```