In [81]:
```
import pandas as pd
import numpy as np
import seaborn as sns
from imblearn.over_sampling import SMOTE, ADASYN
from sklearn import preprocessing
from sklearn.neighbors import KNeighborsClassifier
from sklearn.model_selection import train_test_split
from sklearn.metrics import accuracy_score
from collections import Counter
from sklearn.datasets import make_classification
from sklearn.model_selection import cross_val_score
from imblearn.over_sampling import SMOTE
from imblearn.over_sampling import RandomOverSampler
from sklearn.svm import SVC
from sklearn.neighbors import KernelDensity
import warnings
warnings.filterwarnings("ignore")
```

In [35]:
```
df = pd.read_csv('d17008_Iqbal_pdf.csv')#'kartal.csv'
df = df.sort_values(by='Item', ascending=True)
df.index = df['Item'].values
del df['Item']
df.head()
```

Out[35]:

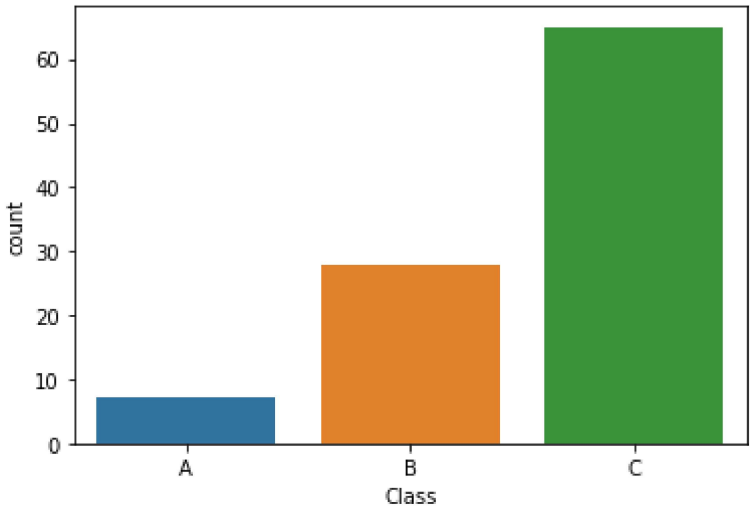
| | Annual\nRequirement | Average\nUnit\nCost\n(Dollars) | Lead\nTime\n(Weeks) |
|---|---|---|---|
| **1** | 44460 | 39.25 | 12 |
| **2** | 89600 | 2.49 | 12 |
| **3** | 28200 | 81.45 | 6 |
| **4** | 113544 | 25.32 | 6 |
| **5** | 20400 | 38.10 | 12 |

In [52]:
```
le = preprocessing.LabelEncoder()

nb = pd.DataFrame({
    "V+": np.zeros(len(df.columns)), # ideal best
```

```
    "V-": np.zeros(len(df.columns))  # ideal worst
}).T

dff = df.copy()
d_f = df.copy()
dff.head()

w = [.4,.4,.2]

for i in range(len(df.columns)):
    dff.iloc[:,i] = (df.iloc[:,i] / np.sqrt(( df.iloc[:,0] ** 2 ).sum())) * w[i]
    if i == 1 or i == 2: # non-benificial, lower value is desired, lower value is ideal best, higher value is ideal worst

        nb.iloc[0,i] = dff.iloc[:,i].min() #non-benificial - lower value ideal best
        nb.iloc[1,i] = dff.iloc[:,i].max() #non-benificial - higher value ideal worst


    else:                   # benificial, higher value is desired, higher value is ideal best, lower value is ideal worst

        nb.iloc[0,i] = dff.iloc[:,i].max() #benificial - higher value ideal best
        nb.iloc[1,i] = dff.iloc[:,i].min() #benificial - lower value ideal worst

nb.columns = df.columns

temp1 = dff.copy()
temp2 = dff.copy()

for i in range(len(df.columns)):
    temp1.iloc[:,i] = (temp1.iloc[:,i] - nb.iloc[0,i]) ** 2


for i in range(len(df.columns)):
    temp2.iloc[:,i] = (temp1.iloc[:,i] - nb.iloc[1,i]) ** 2


dff['S+'] = 0
dff['S-'] = 0

for i in range(len(df)):
    dff.iloc[i,-2] = np.sqrt(temp1.iloc[i,:].sum(axis = 0))
    dff.iloc[i,-1] = np.sqrt(temp2.iloc[i,:].sum(axis = 0))


dff['S+ + S-'] = 0
```

```
dff['p'] = 0

dff['S+ + S-'] = dff['S+'] + dff['S-']

dff['p'] = dff['S-'] / dff['S+ + S-']

d_f['p'] = dff['p']
d_f = d_f.sort_values(by='p', ascending=False) # heighest P value has the top rank

d_f['RunCumCost'] = d_f['p'].cumsum()
TotSum = d_f['p'].sum()
d_f['RunCostPerc'] = (d_f['RunCumCost']/TotSum)*100

def ABC_segmentation(perc):

#top A - top 20%, C - last 50% and B - between A & C

    if perc <=20 :
        return 'A'
    elif perc > 20 and perc < 50:
        return 'B'
    elif perc >= 50:
        return 'C'

d_f['Class'] = d_f['RunCostPerc'].apply(ABC_segmentation)
ax = sns.countplot(x = d_f['Class'],data = d_f,label= 'Count')

d_f['Class'].value_counts()
```

Out[52]:
```
C    65
B    28
A     7
Name: Class, dtype: int64
```




In [53]:
```
d_f.head(5)
```

Out[53]:

| | Annual\nRequirement | Average\nUnit\nCost\n(Dollars) | Lead\nTime\n(Weeks) | p | RunCumCost | RunCostPerc | Class |
|---|---|---|---|---|---|---|---|
| **9** | 120000 | 2.21 | 8 | 0.999460 | 0.999460 | 10.388953 | A |
| **4** | 113544 | 25.32 | 6 | 0.361763 | 1.361222 | 14.149321 | A |

In [61]:
```
X = d_f.iloc[:,0:3].copy()
y = d_f.iloc[:,-1].copy()
y = le.fit_transform(y)
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.3, random_state=42)
```

In [106…
```
model = KNeighborsClassifier(n_neighbors = 5, metric = 'minkowski', p=2)
model.fit(X_train, y_train)
y_pred = model.predict(X_test)
print("********KNN********")
print("test acc: ",accuracy_score(y_test, y_pred))
print("train acc: ",accuracy_score(y_train, model.predict(X_train)))
```

```
********KNN********
test acc:  0.98
train acc:  0.9971428571428571
```

In [107…

```
model = SVC(kernel = 'poly')
model.fit(X_train, y_train)
y_pred = model.predict(X_test)
print("********SVC********")
print("train acc: ",accuracy_score(y_train, model.predict(X_train)))
print("test acc: ",accuracy_score(y_test, y_pred))
```

```
********SVC********
train acc:  0.7342857142857143
test acc:  0.6866666666666666
```

# Random Over Sampling

In [149…

```
sampling_strategy = {0: 20*10, 1:30*10, 2:50*10}
X_res, y_res = RandomOverSampler(sampling_strategy = sampling_strategy).fit_resample(d_f.iloc[:,0:3], \
                                                                                     le.fit_transform(d_f['Class']))

X_train, X_test, y_train, y_test = train_test_split(X_res, y_res, test_size=0.2, random_state=42)
```

In [150…

```
modelKNN = KNeighborsClassifier(n_neighbors = 3, p =1)#, metric = 'minkowski', p=2)
modelKNN.fit(X_train, y_train)
y_pred = modelKNN.predict(X_test)

scores = cross_val_score(modelKNN, X_train, y_train, cv=10)
print("********KNN********")
print("train acc: ",accuracy_score(y_train, modelKNN.predict(X_train)))
print("test acc: ",accuracy_score(y_test, y_pred))
print("cv score: ",scores.mean())
```

```
********KNN********
train acc:  1.0
test acc:  1.0
cv score:  1.0
```

In [151…

```
modelSVC = SVC(kernel = 'poly')
modelSVC.fit(X_train, y_train)
y_pred = modelSVC.predict(X_test)
scores = cross_val_score(modelSVC, X_train, y_train, cv=10)
print("********SVC********")
print("train acc: ",accuracy_score(y_train, modelSVC.predict(X_train)))
print("test acc: ",accuracy_score(y_test, y_pred))
print("cv score: ",scores.mean())
```

```
********SVC********
train acc:  0.69125
test acc:  0.72
cv score:  0.6875000000000001
```

In [154…

```
d_f.to_csv("Classed.csv")
```

In [156…

```
dff.to_csv("TopsisData")
```

In [157…

```
nb
```

Out[157…

| | Annual\nRequirement | Average\nUnit\nCost\n(Dollars) | Lead\nTime\n(Weeks) |
|---|---|---|---|
| **V+** | 0.151502 | 0.000003 | 0.000003 |
| **V-** | 0.004681 | 0.000216 | 0.000010 |

In [ ]: