In [1]:
```
import numpy as np
import pandas as pd
import seaborn as sns
import math
import operator
import warnings
warnings.filterwarnings('ignore')
import matplotlib.pyplot as plt
from sklearn import preprocessing
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import LabelEncoder, OneHotEncoder
from sklearn.preprocessing import StandardScaler
from sklearn.decomposition import PCA
from sklearn import manifold
from sklearn.preprocessing import MinMaxScaler
```

In [2]:
```
col=["c_type", "lifestyle", "vacation", "credit", "salary", "property_value", "cl
```

In [3]:
```
train_data=pd.read_csv("trainProdSelection.arff", delimiter="\t")
test_data=pd.read_csv("testProdSelection.arff",delimiter="\t")
```

In [4]:
```
train_data.columns=col
```

In [5]:
```
train_data.head()
train_data.shape
```

Out[5]: (185, 7)

In [6]:
```
test_data.columns=col
test_data.head()
```

Out[6]:

	c_type	lifestyle	vacation	credit	salary	property_value	class
0	student	spend>>saving	29	10	16.1900	2.4839	C1
1	student	spend<<saving	28	60	15.4600	1.1885	C1
2	engineer	spend>saving	15	41	21.2600	1.4379	C1
3	librarian	spend<saving	2	9	19.7207	0.6913	C1
4	librarian	spend>saving	7	9	12.7098	1.4728	C1

In [7]:
```
train_data.describe()
```

Out[7]:

	vacation	credit	salary	property_value
count	185.000000	185.000000	185.000000	185.000000
mean	27.691892	62.783784	20.702852	4.146650
std	18.572630	69.120537	4.244655	3.775707
min	1.000000	3.000000	8.507600	0.008000
25%	9.000000	15.000000	18.594400	1.644700
50%	26.000000	45.000000	20.390000	2.897200
75%	48.000000	72.000000	22.790000	4.838800
max	64.000000	347.000000	31.750000	17.873700

In [8]:
```
test_data.head()
```

Out[8]:

	c_type	lifestyle	vacation	credit	salary	property_value	class
0	student	spend>>saving	29	10	16.1900	2.4839	C1
1	student	spend<<saving	28	60	15.4600	1.1885	C1
2	engineer	spend>saving	15	41	21.2600	1.4379	C1
3	librarian	spend<saving	2	9	19.7207	0.6913	C1
4	librarian	spend>saving	7	9	12.7098	1.4728	C1

In [9]:
```
train_data.dtypes
```

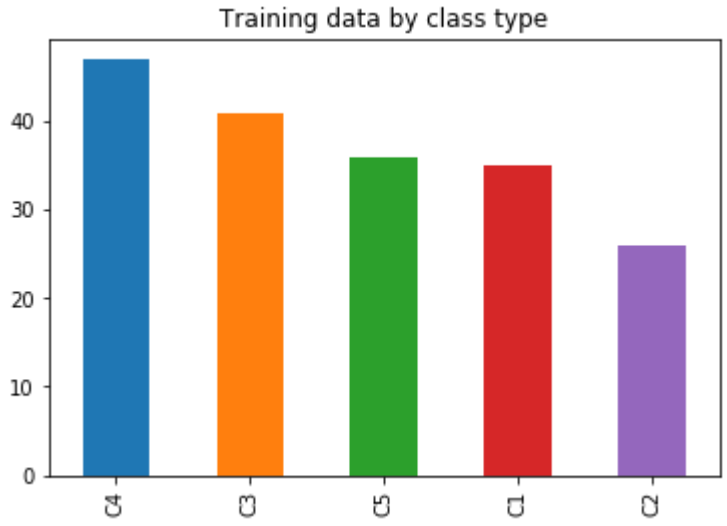
Out[9]:
```
c_type            object
lifestyle         object
vacation           int64
credit             int64
salary           float64
property_value   float64
class             object
dtype: object
```

In [10]:
```
train_data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 185 entries, 0 to 184
Data columns (total 7 columns):
c_type            185 non-null object
lifestyle         185 non-null object
vacation          185 non-null int64
credit            185 non-null int64
salary            185 non-null float64
property_value    185 non-null float64
class             185 non-null object
dtypes: float64(2), int64(2), object(3)
memory usage: 10.2+ KB
```

In [11]:
```
train_data['class'].value_counts().plot(kind='bar', title='Training data by class
```

Out[11]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x1d8387c5b00>
```

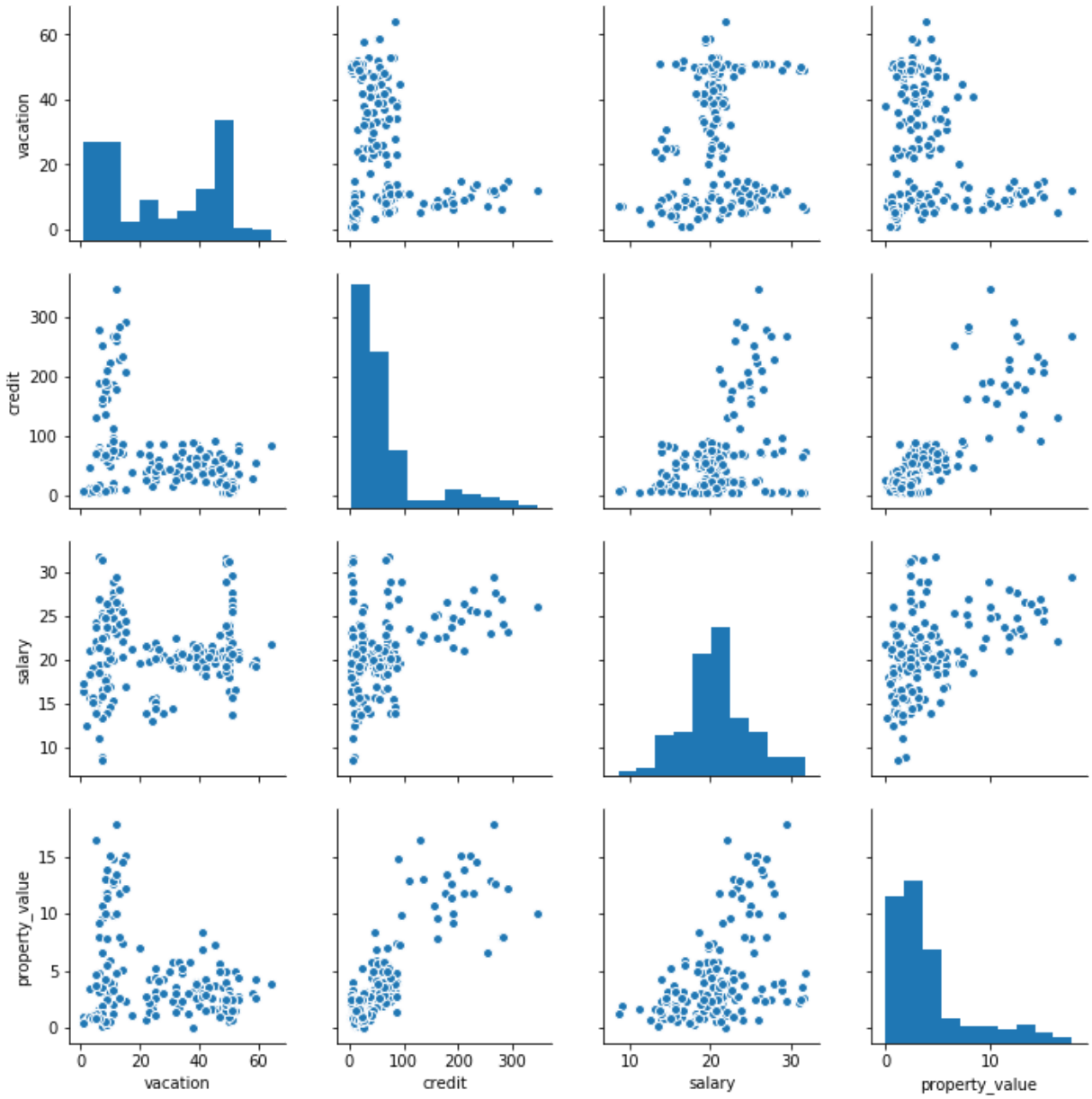


In [12]:
```
corrmat = train_data[1:].corr()
f, ax = plt.subplots(figsize =(6, 5))
sns.heatmap(corrmat, ax = ax, linewidths = 0.1)
```

Out[12]: <matplotlib.axes._subplots.AxesSubplot at 0x1d83a8800b8>

In [13]:
```
sns.pairplot(train_data)
```

Out[13]:
```
<seaborn.axisgrid.PairGrid at 0x1d83a9a6518>
```



In [14]:
```
train_encoded = pd.get_dummies(train_data[['c_type','lifestyle']],drop_first=True
train_encoded.head()
```

Out[14]:

	c_type_engineer	c_type_librarian	c_type_professor	c_type_student	lifestyle_spend<saving	lifest
0	0	0	0	1	0	
1	0	0	0	1	0	
2	0	0	0	1	0	
3	0	0	0	1	0	
4	0	0	0	1	0	

In [15]:
```
test_encoded = pd.get_dummies(test_data[['c_type','lifestyle']],drop_first=True)
test_encoded.head()
```

Out[15]:

	c_type_engineer	c_type_librarian	c_type_professor	c_type_student	lifestyle_spend<saving	lifest
0	0	0	0	1	0	
1	0	0	0	1	0	
2	1	0	0	0	0	
3	0	1	0	0	1	
4	0	1	0	0	0	

In [16]:
```
train_data = train_data.drop(['c_type','lifestyle'],axis=1)
train_data.head()
```

Out[16]:

	vacation	credit	salary	property_value	class
0	11	21	15.32	2.0232	C1
1	7	64	16.55	3.1202	C1
2	3	47	15.71	3.4022	C1
3	15	10	16.96	2.2825	C1
4	6	80	15.50	3.7338	C1

In [17]:
```
test_data = test_data.drop(['c_type','lifestyle'],axis=1)
test_data.head()
```

Out[17]:

	vacation	credit	salary	property_value	class
0	29	10	16.1900	2.4839	C1
1	28	60	15.4600	1.1885	C1
2	15	41	21.2600	1.4379	C1
3	2	9	19.7207	0.6913	C1
4	7	9	12.7098	1.4728	C1

In [18]:
```
train_data_encoded = pd.concat([train_data,train_encoded],axis=1)
train_data_encoded.head()
```

Out[18]:

	vacation	credit	salary	property_value	class	c_type_engineer	c_type_librarian	c_type_profess
0	11	21	15.32	2.0232	C1	0	0	
1	7	64	16.55	3.1202	C1	0	0	
2	3	47	15.71	3.4022	C1	0	0	
3	15	10	16.96	2.2825	C1	0	0	
4	6	80	15.50	3.7338	C1	0	0	

In [19]:
```
test_data_encoded = pd.concat([test_data,train_encoded],axis=1)
test_data_encoded.head()
```

Out[19]:

	vacation	credit	salary	property_value	class	c_type_engineer	c_type_librarian	c_type_profes
0	29.0	10.0	16.1900	2.4839	C1	0	0	
1	28.0	60.0	15.4600	1.1885	C1	0	0	
2	15.0	41.0	21.2600	1.4379	C1	0	0	
3	2.0	9.0	19.7207	0.6913	C1	0	0	
4	7.0	9.0	12.7098	1.4728	C1	0	0	

In [20]:
```
y_train = train_data_encoded['class']
y_test = test_data_encoded['class']
```

In [21]:
```
X_train = train_data_encoded.drop(["class"],axis=1)
X_test = test_data_encoded.drop(["class"],axis=1)
```

In [22]:
```
X_test = X_test[0:21]
y_test = y_test[0:21]
```

In [23]:
```
scaler = MinMaxScaler()
X_train = pd.DataFrame(scaler.fit_transform(X_train))
X_test = pd.DataFrame(scaler.fit_transform(X_test))
```

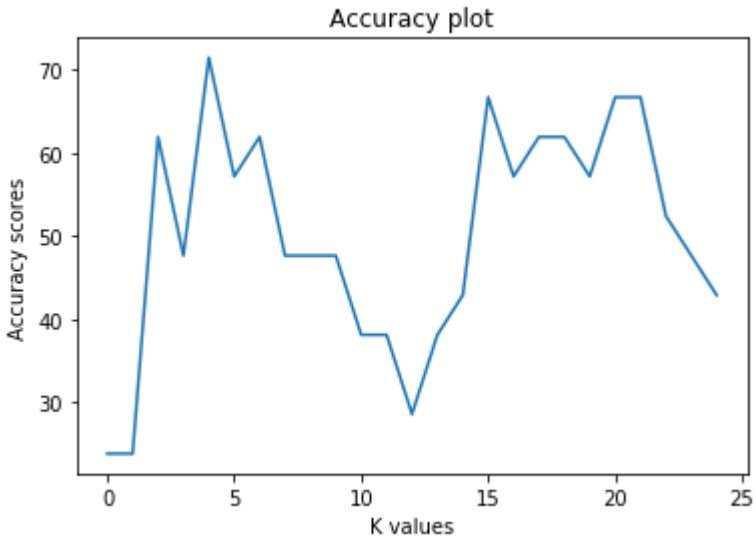
In [24]:
```
X_train.index=range(len(X_train))
y_train.index=range(len(y_train))
X_test.index=range(len(X_test))
y_test.index=range(len(y_test))
```

In [25]:
```
def distNeighbours(X_train,Y_train,X_test,K):
    distance=[]
    for i in range(len(X_train)):
        eDistance=0
        for j in range(len(X_train.columns)):
                eDistance+=round(np.sqrt(pow((X_train.iloc[i,j]-X_test[j]),2)),2)
        distance.append((eDistance,i,Y_train.iloc[i]))
        distance=sorted(distance, key=lambda x: x[0])[0:K]
    return distance
def predictOutputCategorical(X_train,Y_train,X_test,K):
    neighbours=[]
    responses=[]
    for i in range(len(X_test)):
        neighbours.append(distNeighbours(X_train,Y_train,X_test.iloc[i,:],K))
    for i in neighbours:
        votes={}
        for j in i:
            if j[-1] in votes.keys():
                votes[j[-1]]=votes[j[-1]]+1
            else:
                votes[j[-1]]=1
        responses.append(sorted(votes,key=votes.get,reverse=True)[0])
    return responses
def predictOutputNumeric(X_train,Y_train,X_test,K):
    neighbours=[]
    responses=[]
    for i in range(len(X_test)):
        neighbours.append(distNeighbours(X_train,Y_train,X_test.iloc[i,:],K))
    for i in neighbours:
        mean=0
        for j in i:
            mean+=j[-1]
        mean=mean/K
        responses.append(mean)
    return responses
def getAccuracyCategorical(actual,predicted):
    correct=0
    for i in range(len(predicted)):
        if predicted[i]==actual[i]:
            correct+=1
    return round((correct/len(actual))*100,2)
def getAccuracyNumeric(actual,predicted):
    error=0
    for i in range(len(predicted)):
        error+=pow((actual[i]-predicted[i]),2)
    error=error/len(predicted)-1
    return 100-error
acc = []
for i in range(1,26):
  output = predictOutputCategorical(X_train,y_train,X_test,i)
  acc_i = getAccuracyCategorical(y_test,output)
  print("for k = ",i," accuracy = ",acc_i)
  acc.append(acc_i)
```

```
for k =  1  accuracy =  23.81
for k =  2  accuracy =  23.81
```

```
for k =  3  accuracy =  61.9
for k =  4  accuracy =  47.62
for k =  5  accuracy =  71.43
for k =  6  accuracy =  57.14
for k =  7  accuracy =  61.9
for k =  8  accuracy =  47.62
for k =  9  accuracy =  47.62
for k =  10  accuracy =  47.62
for k =  11  accuracy =  38.1
for k =  12  accuracy =  38.1
for k =  13  accuracy =  28.57
for k =  14  accuracy =  38.1
for k =  15  accuracy =  42.86
for k =  16  accuracy =  66.67
for k =  17  accuracy =  57.14
for k =  18  accuracy =  61.9
for k =  19  accuracy =  61.9
for k =  20  accuracy =  57.14
for k =  21  accuracy =  66.67
for k =  22  accuracy =  66.67
for k =  23  accuracy =  52.38
for k =  24  accuracy =  47.62
for k =  25  accuracy =  42.86
```

In [26]:
```
y_positions = range(25)
plt.plot(y_positions, acc)
plt.xlabel('K values')
plt.ylabel('Accuracy scores')
#title
plt.title("Accuracy plot")
plt.show()
```



In [ ]:
```

```