Assignment 5

1. Choose a REGRESSION dataset (reusing bikeshare is allowed), perform a test/train split, and build a regression model (just like in assignment 3), and calculate the

+ Training Error (MSE, MAE)
+ Testing Error (MSE, MAE)

2. Choose a CLASSIFICATION dataset (not the adult.data set, The UCI repository has many datasets as well as Kaggle), perform test/train split and create a classification model (your choice but DecisionTree is fine). Calculate

+ Accuracy
+ Confusion Matrix
+ Classifcation Report

3. (Bonus) See if you can improve the classification model's performance with any tricks you can think of (modify features, remove features, polynomial features)

In [53]:
```
import seaborn as sns
import matplotlib.pyplot as plt
%matplotlib inline
plt.rcParams['figure.figsize'] = (20, 6)
plt.rcParams['font.size'] = 14
import pandas as pd
import numpy as np
from sklearn import linear_model, metrics
from sklearn.model_selection import train_test_split
from sklearn.tree import DecisionTreeClassifier
from sklearn.ensemble import RandomForestClassifier
from sklearn.preprocessing import PolynomialFeatures
from sklearn.tree import DecisionTreeClassifier
from sklearn.ensemble import RandomForestClassifier
from sklearn.metrics import (accuracy_score,
                             classification_report,
                             confusion_matrix, auc, roc_curve
                            )
```

In [13]:
```
df = pd.read_csv('bikeshare_hour_count.csv')
```

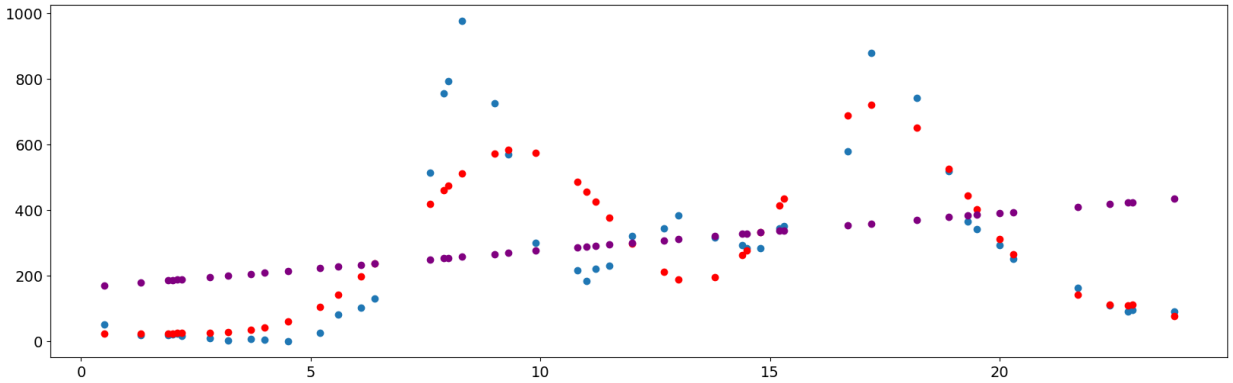
In [18]:
```
hour = df.hour.values.reshape(-1,1)
friday = df.friday.values.reshape(-1,1)
```

In [20]:
```
#1-Friday
xtrain, xtest, ytrain, ytest = train_test_split(hour, friday, test_size = 0.2)
linear = linear_model.LinearRegression().fit(xtrain, ytrain)
```

In [23]:
```
xtrain15 = PolynomialFeatures(degree = 15).fit_transform(xtrain)
xtest15 = PolynomialFeatures(degree = 15).fit_transform(xtest)
linear15 = linear_model.LinearRegression().fit(xtrain15, ytrain)
```

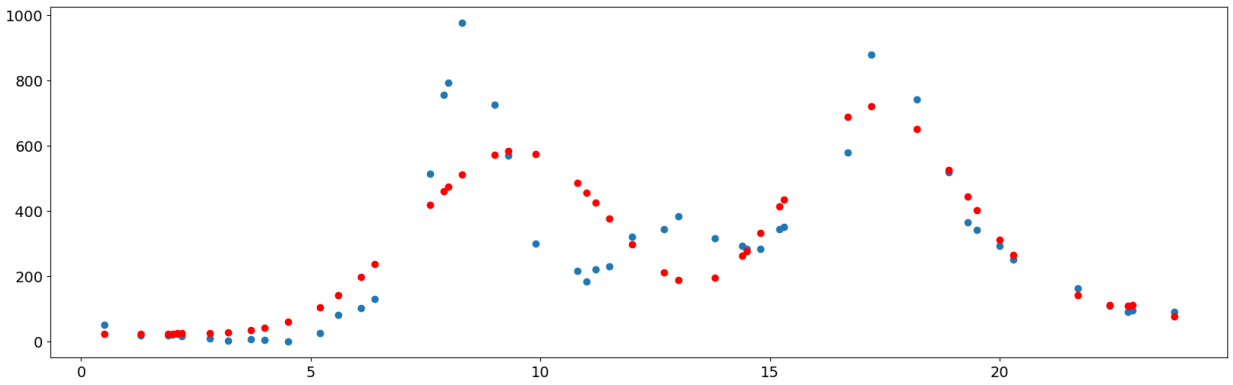
In [26]:
```
plt.scatter(xtest, ytest)
plt.scatter(xtest, linear15.predict(xtest15), c = 'red')
plt.scatter(xtest, linear.predict(xtest), c = 'purple')
```

Out[26]:
```
<matplotlib.collections.PathCollection at 0x263aae5dae0>
```



In [27]:
```
##Taking normal linear prediction out for clarity
plt.scatter(xtest, ytest)
plt.scatter(xtest, linear15.predict(xtest15), c = 'red')
```

Out[27]:
```
<matplotlib.collections.PathCollection at 0x263aa92e620>
```



In [30]:
```
#Training Error
(
metrics.mean_squared_error(ytrain, linear15.predict(xtrain15)),
metrics.mean_absolute_error(ytrain, linear15.predict(xtrain15))
)
```

Out[30]:
```
(19934.108989660843, 91.20506199152389)
```

In [31]:
```
#Testing Error
(
metrics.mean_squared_error(ytest, linear15.predict(xtest15)),
metrics.mean_absolute_error(ytest, linear15.predict(xtest15))
)
```

Out[31]:
```
(18728.24953373297, 91.26487374003807)
```

In [112…
```
#2-Credit Dataset - Predict Credit Rating greater than 300
#RatingKey represents a 1 if the rating is equal to or higher a 300 and a 0 if it is u
data = pd.read_csv('Credit.csv')
test = pd.read_csv('Credit_Test.csv')
```

In [113…
```
data.columns
```

Out[113]:
```
Index(['Income', 'Limit', 'Rating', 'Cards', 'Age', 'Education', 'Gender',
       'Student', 'Married', 'Ethnicity', 'Balance', 'RatingKey'],
      dtype='object')
```

In [114…
```
non_numeric_columns = ['Gender', 'Student', 'Married', 'Ethnicity', 'Rating']
```

In [115…
```
x = data.copy().drop(non_numeric_columns, axis = 1)
```

In [116…
```
xt = test.copy().drop(non_numeric_columns, axis = 1)
```

In [117…
```
xt.RatingKey.value_counts()
```

Out[117]:
```
1    176
0    124
Name: RatingKey, dtype: int64
```

In [118…
```
model = DecisionTreeClassifier(criterion = 'entropy')
```

In [119…
```
model.fit(x.drop(['RatingKey'], axis = 1), x.RatingKey)
```

Out[119]:
```
DecisionTreeClassifier(criterion='entropy')
```

In [120…
```
list(zip(x.drop(['RatingKey'], axis = 1).columns, model.feature_importances_))
```

Out[120]:
```
[('Income', 0.0),
 ('Limit', 1.0),
 ('Cards', 0.0),
 ('Age', 0.0),
 ('Education', 0.0),
 ('Balance', 0.0)]
```

In [121…
```
x.drop(['RatingKey'] , axis = 1).head()
```

Out[121]:

	Income	Limit	Cards	Age	Education	Balance
0	14.891	3606	2	34	11	333
1	106.025	6645	3	82	15	903
2	104.593	7075	4	71	11	580
3	148.924	9504	3	36	11	964
4	55.882	4897	2	68	16	331

In [122…
```
set(x.columns) - set(xt.columns)
```

Out[122]:
```
set()
```

In [129…
```
predictions = model.predict(xt.drop(['RatingKey'], axis = 1))
```

In [130…
```
predictions_train = model.predict(x.drop(['RatingKey'], axis = 1))
```

In [131…
```
xt.drop(['RatingKey'], axis = 1).head()
```

Out[131]:

	Income	Limit	Cards	Age	Education	Balance
0	21.153	3736	1	41	11	298
1	17.976	2433	3	70	16	431
2	68.713	7582	2	56	16	1587
3	146.183	9540	6	66	15	1050
4	15.846	4768	4	53	12	745

In [134…
```
accuracy_score(xt.RatingKey, predictions)
```

Out[134]:
```
0.9566666666666667
```

In [136…
```
predictions.shape, xt.RatingKey.values.shape
```

Out[136]:
```
((300,), (300,))
```

In [137…
```
(xt.RatingKey.values == predictions).sum()/len(predictions)
```

Out[137]:
```
0.9566666666666667
```

In [138…
```
np.logical_and(xt.RatingKey.values, predictions).sum()
```

Out[138]:
```
175
```

In [139…
```
confusion_matrix(xt.RatingKey, predictions)
```

Out[139]:
```
array([[112,  12],
       [  1, 175]], dtype=int64)
```

In [140…
```
print(classification_report(xt.RatingKey, predictions))
```

	precision	recall	f1-score	support
0	0.99	0.90	0.95	124
1	0.94	0.99	0.96	176
accuracy			0.96	300
macro avg	0.96	0.95	0.95	300
weighted avg	0.96	0.96	0.96	300

In [ ]: