In [1]:
```
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
from sklearn.ensemble import RandomForestClassifier
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import confusion_matrix, classification_report,accuracy_score
from sklearn.preprocessing import StandardScaler, LabelEncoder
from sklearn.model_selection import train_test_split, cross_val_score
import warnings
warnings.filterwarnings('ignore')
```

In [2]:
```
df = pd.read_csv('winequality-red.csv')
```

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

Out[3]:

| | fixed acidity | volatile acidity | citric acid | residual sugar | chlorides | free sulfur dioxide | total sulfur dioxide | density | pH | sulphates | alcohol |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 7.4 | 0.70 | 0.00 | 1.9 | 0.076 | 11.0 | 34.0 | 0.9978 | 3.51 | 0.56 | 9.4 |
| **1** | 7.8 | 0.88 | 0.00 | 2.6 | 0.098 | 25.0 | 67.0 | 0.9968 | 3.20 | 0.68 | 9.8 |
| **2** | 7.8 | 0.76 | 0.04 | 2.3 | 0.092 | 15.0 | 54.0 | 0.9970 | 3.26 | 0.65 | 9.8 |
| **3** | 11.2 | 0.28 | 0.56 | 1.9 | 0.075 | 17.0 | 60.0 | 0.9980 | 3.16 | 0.58 | 9.8 |
| **4** | 7.4 | 0.70 | 0.00 | 1.9 | 0.076 | 11.0 | 34.0 | 0.9978 | 3.51 | 0.56 | 9.4 |

In [4]:
```
df.info()
```

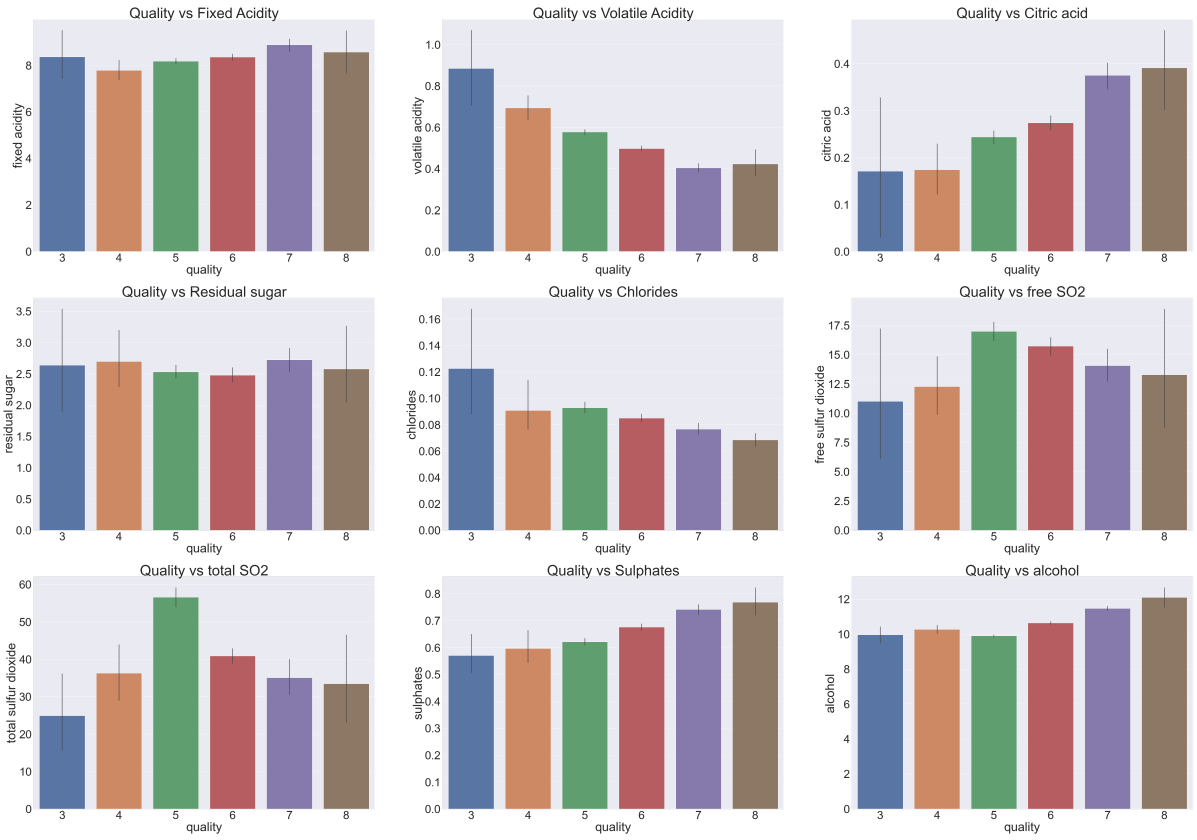
```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1599 entries, 0 to 1598
Data columns (total 12 columns):
 #   Column                Non-Null Count  Dtype  
---  ------                --------------  -----  
 0   fixed acidity         1599 non-null   float64
 1   volatile acidity      1599 non-null   float64
 2   citric acid           1599 non-null   float64
 3   residual sugar        1599 non-null   float64
 4   chlorides             1599 non-null   float64
 5   free sulfur dioxide   1599 non-null   float64
 6   total sulfur dioxide  1599 non-null   float64
 7   density               1599 non-null   float64
 8   pH                    1599 non-null   float64
 9   sulphates             1599 non-null   float64
 10  alcohol               1599 non-null   float64
 11  quality               1599 non-null   int64  
dtypes: float64(11), int64(1)
memory usage: 150.0 KB
```

In [5]:
```
plt.figure(figsize=(100,70))
sns.set(font_scale=5)
plt.subplot(331)
plt.title("Quality vs Fixed Acidity",fontsize=70)
sns.barplot(x = 'quality', y = 'fixed acidity', data = df)

plt.subplot(332)
plt.title("Quality vs Volatile Acidity",fontsize=70)
sns.barplot(x = 'quality', y = 'volatile acidity', data = df)
```

```
plt.subplot(333)
plt.title("Quality vs Citric acid",fontsize=70)
sns.barplot(x = 'quality', y = 'citric acid', data = df)

plt.subplot(334)
plt.title("Quality vs Residual sugar",fontsize=70)
sns.barplot(x = 'quality', y = 'residual sugar', data = df)

plt.subplot(335)
plt.title("Quality vs Chlorides",fontsize=70)
sns.barplot(x = 'quality', y = 'chlorides', data = df)

plt.subplot(336)
plt.title("Quality vs free SO2",fontsize=70)
sns.barplot(x = 'quality', y = 'free sulfur dioxide', data = df)

plt.subplot(337)
plt.title("Quality vs total SO2",fontsize=70)
sns.barplot(x = 'quality', y = 'total sulfur dioxide', data = df)

plt.subplot(338)
plt.title("Quality vs Sulphates",fontsize=70)
sns.barplot(x = 'quality', y = 'sulphates', data = df)

plt.subplot(339)
plt.title("Quality vs alcohol",fontsize=70)
sns.barplot(x = 'quality', y = 'alcohol', data = df)
```

Out[5]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x1a1f43d4a8>
```




In [6]:

```
bins = (2, 6.5, 8)
classes = ['bad','good']
df['quality'] = pd.cut(df['quality'], bins = bins, labels = classes)
```

In [7]:

```
label_quality = LabelEncoder()
```

In [8]:
```
df['quality'] = label_quality.fit_transform(df['quality'])
```

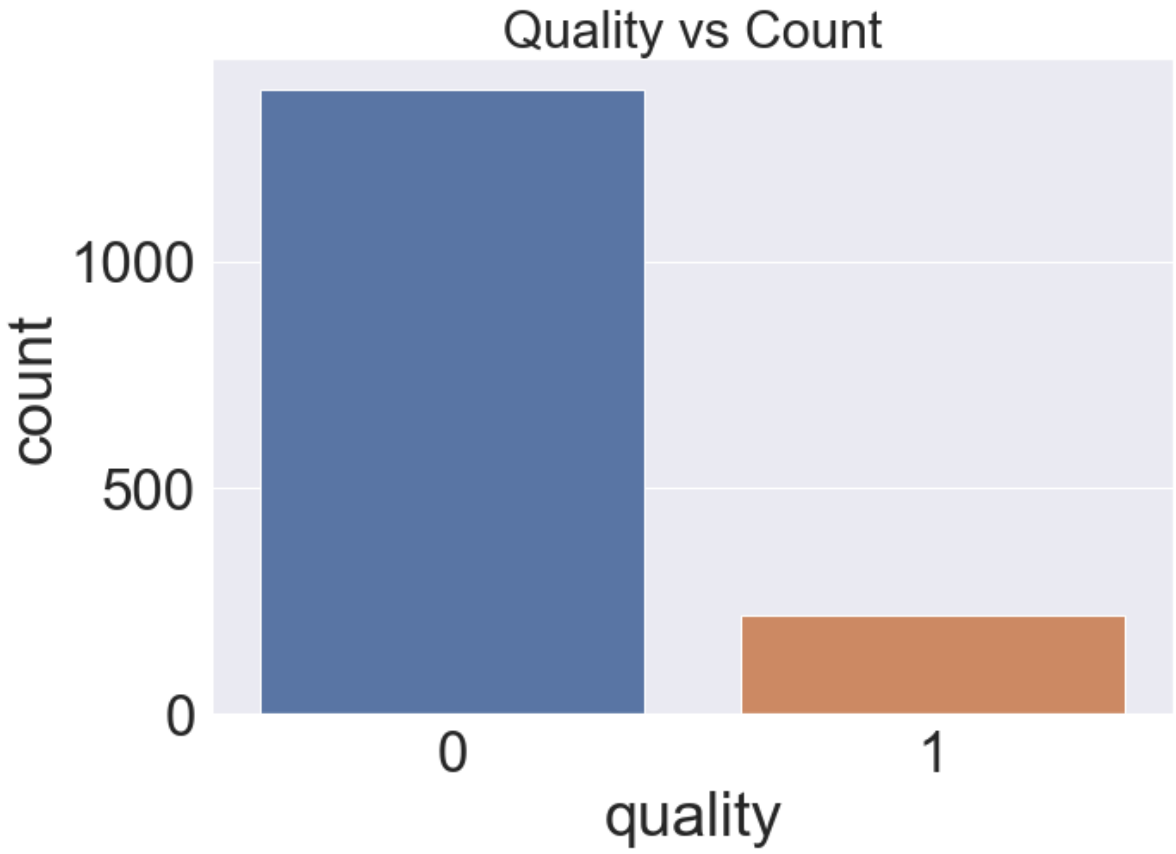
In [9]:
```
df['quality'].value_counts()
```

Out[9]:
```
0    1382
1     217
Name: quality, dtype: int64
```

## So 0 indicates bad and 1 indicates good

In [10]:
```
plt.figure(figsize=(10,7))
sns.set(font_scale=3)
plt.title("Quality vs Count",fontsize=30)
sns.countplot(df['quality'])
```

Out[10]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x1a28073080>
```




In [11]:
```
df.head()
```

Out[11]:

| | fixed acidity | volatile acidity | citric acid | residual sugar | chlorides | free sulfur dioxide | total sulfur dioxide | density | pH | sulphates | alcohol |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 7.4 | 0.70 | 0.00 | 1.9 | 0.076 | 11.0 | 34.0 | 0.9978 | 3.51 | 0.56 | 9.4 |
| **1** | 7.8 | 0.88 | 0.00 | 2.6 | 0.098 | 25.0 | 67.0 | 0.9968 | 3.20 | 0.68 | 9.8 |
| **2** | 7.8 | 0.76 | 0.04 | 2.3 | 0.092 | 15.0 | 54.0 | 0.9970 | 3.26 | 0.65 | 9.8 |
| **3** | 11.2 | 0.28 | 0.56 | 1.9 | 0.075 | 17.0 | 60.0 | 0.9980 | 3.16 | 0.58 | 9.8 |
| **4** | 7.4 | 0.70 | 0.00 | 1.9 | 0.076 | 11.0 | 34.0 | 0.9978 | 3.51 | 0.56 | 9.4 |

In [12]:
```
X = df.drop('quality', axis = 1)
Y = df['quality']
```

In [13]:
```
X_train, X_test, Y_train, Y_test = train_test_split(X, Y, test_size = 0.2, random_
```

In [14]:
```
sc = StandardScaler()
```

In [15]:
```
X_train = sc.fit_transform(X_train)
X_test = sc.fit_transform(X_test)
```

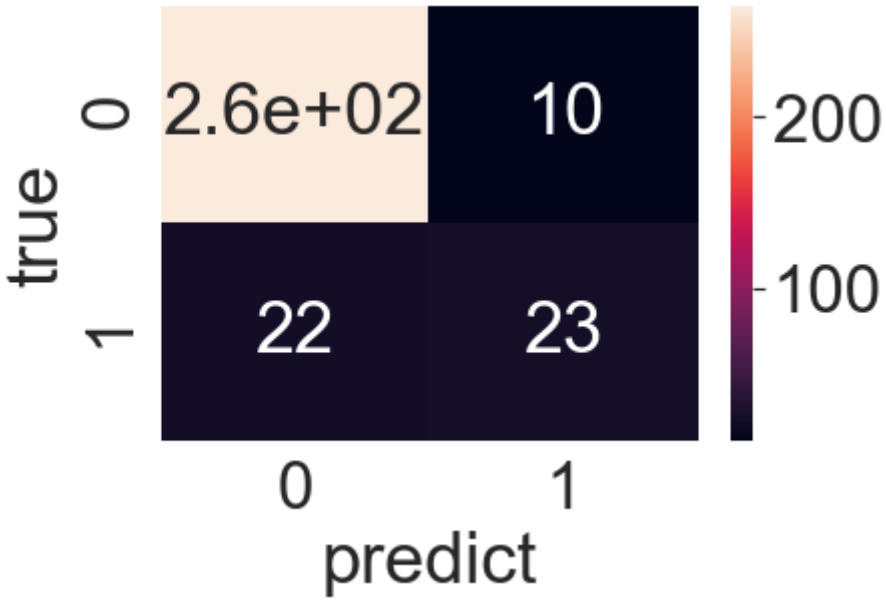
## Random Forest Classifier

In [16]:
```
RF = RandomForestClassifier(n_estimators=100)
RF.fit(X_train, Y_train)
pred_RF = RF.predict(X_test)
```

In [17]:
```
pred1 = accuracy_score(Y_test,pred_RF)
print(pred1*100)
```

```
90.0
```

In [18]:
```
cm1=confusion_matrix(Y_test, pred_RF)
ax1 = sns.heatmap(cm1,annot=True)
ax1.set(xlabel='predict', ylabel='true')
plt.show()
```

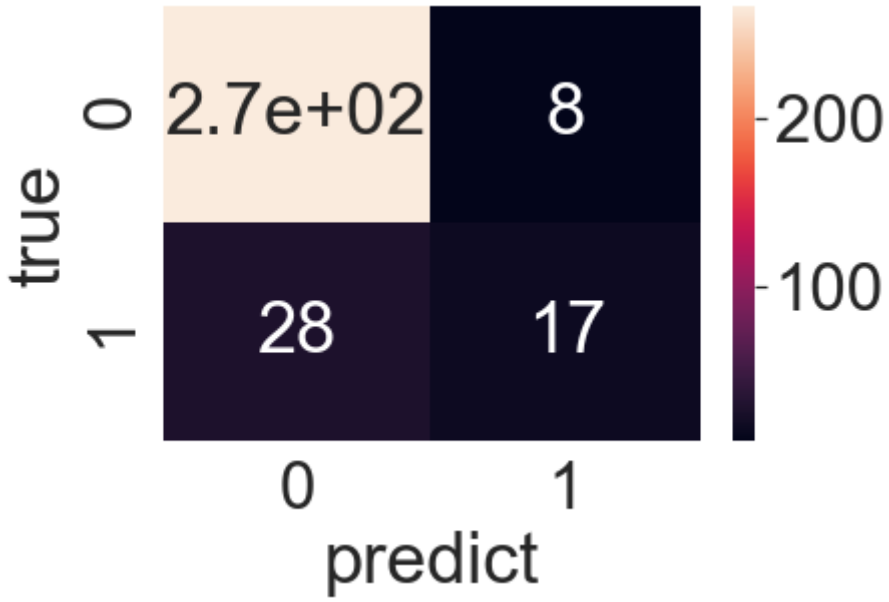



## Logistic Regression

In [19]:
```
LR = LogisticRegression().fit(X_train,Y_train)
```

In [20]:
```
pred_LR = LR.predict(X_test)
cm2 = confusion_matrix(Y_test,pred_LR)
ax2 = sns.heatmap(cm2,annot=True)
ax2.set(xlabel='predict', ylabel='true')
pred2 = accuracy_score(Y_test,pred_LR)
print("logistic regression accuracy score: ",pred2*100)
```

```
logistic regression accuracy score:  88.75
```




In [ ]: