import libraries

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In [1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
%matplotlib inline
import seaborn as sns
```

In [2]:
```
df = pd.read_csv('../input/abalone.csv')
```

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

Out[3]:

	Sex	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Rings
0	M	0.455	0.365	0.095	0.5140	0.2245	0.1010	0.150	15
1	M	0.350	0.265	0.090	0.2255	0.0995	0.0485	0.070	7
2	F	0.530	0.420	0.135	0.6770	0.2565	0.1415	0.210	9
3	M	0.440	0.365	0.125	0.5160	0.2155	0.1140	0.155	10
4	I	0.330	0.255	0.080	0.2050	0.0895	0.0395	0.055	7

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

Out[4]:

	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Rings
count	4177.000000	4177.000000	4177.000000	4177.000000	4177.000000	4177.000000	4177.000000	4177.000000
mean	0.523992	0.407881	0.139516	0.828742	0.359367	0.180594	0.238831	9.933684
std	0.120093	0.099240	0.041827	0.490389	0.221963	0.109614	0.139203	3.224169
min	0.075000	0.055000	0.000000	0.002000	0.001000	0.000500	0.001500	1.000000

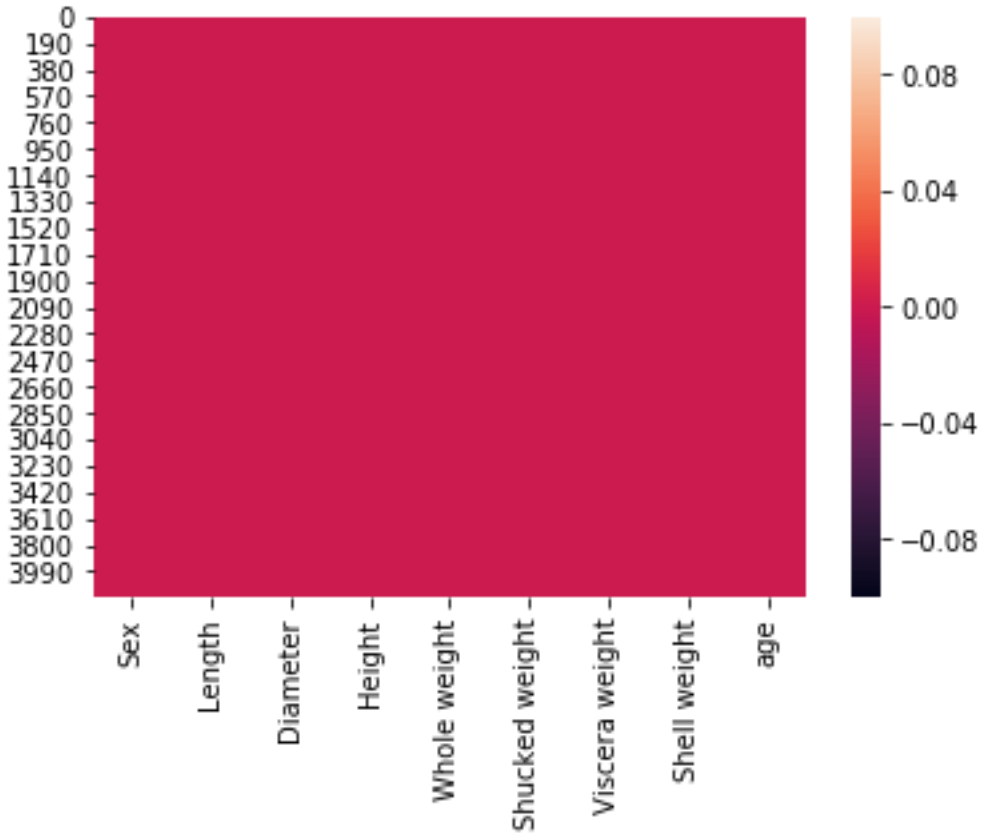
	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Rings
25%	0.450000	0.350000	0.115000	0.441500	0.186000	0.093500	0.130000	8.000000
50%	0.545000	0.425000	0.140000	0.799500	0.336000	0.171000	0.234000	9.000000
75%	0.615000	0.480000	0.165000	1.153000	0.502000	0.253000	0.329000	11.000000
max	0.815000	0.650000	1.130000	2.825500	1.488000	0.760000	1.005000	29.000000

In [5]:
```
df['age'] = df['Rings']+1.5
df = df.drop('Rings', axis = 1)
```

EDA

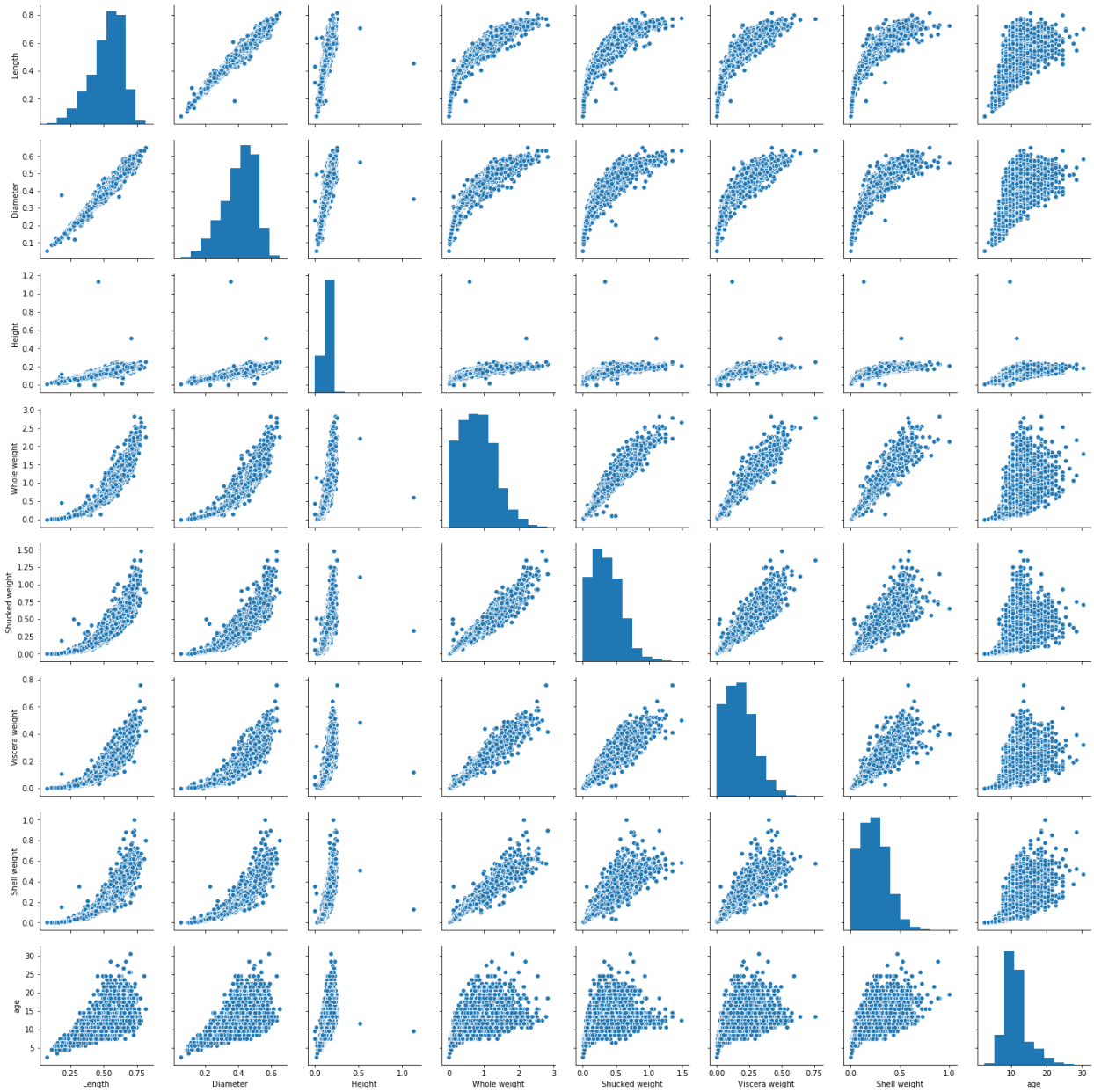
In [6]:
```
sns.heatmap(df.isnull())
```

Out[6]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7fcc468da358>
```



```
In[7]: sns.pairplot(df)
```

Out[7]: <seaborn.axisgrid.PairGrid at 0x7fcc3caa8160>




```
In[8]: df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 4177 entries, 0 to 4176
```

```
Data columns (total 9 columns):
Sex                4177 non-null object
Length             4177 non-null float64
Diameter           4177 non-null float64
Height             4177 non-null float64
Whole weight       4177 non-null float64
Shucked weight     4177 non-null float64
Viscera weight     4177 non-null float64
Shell weight       4177 non-null float64
age                4177 non-null float64
dtypes: float64(8), object(1)
memory usage: 293.8+ KB
```

In [9]:
```
numerical_features = df.select_dtypes(include = [np.number]).columns
categorical_features = df.select_dtypes(include = [np.object]).columns
```

In [10]:
```
numerical_features
```

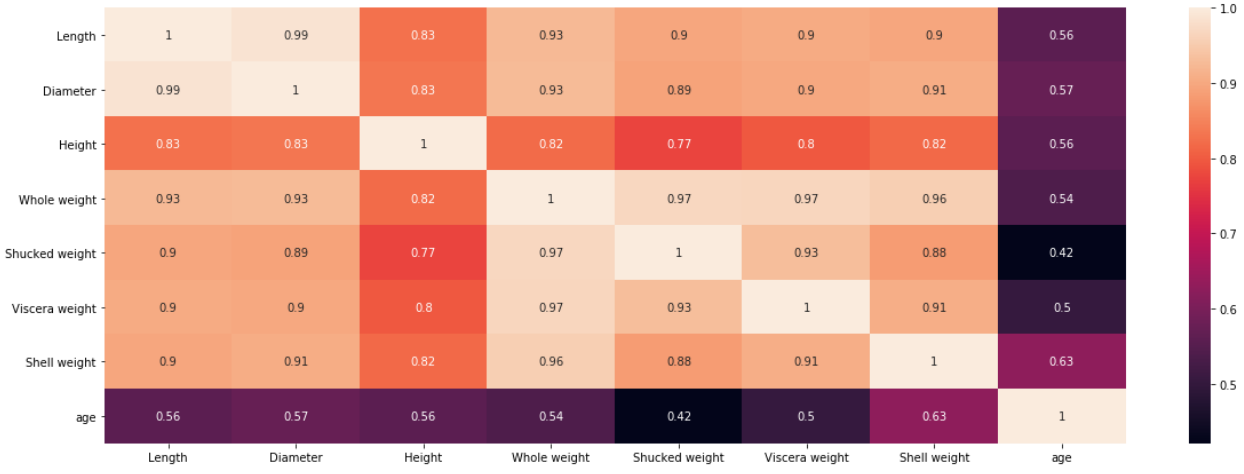
Out[10]:
```
Index(['Length', 'Diameter', 'Height', 'Whole weight', 'Shucked
weight', 'Viscera weight', 'Shell weight', 'age'],dtype='object')
```

In [11]:
```
categorical_features
```

Out[11]:
```
Index(['Sex'], dtype='object')
```

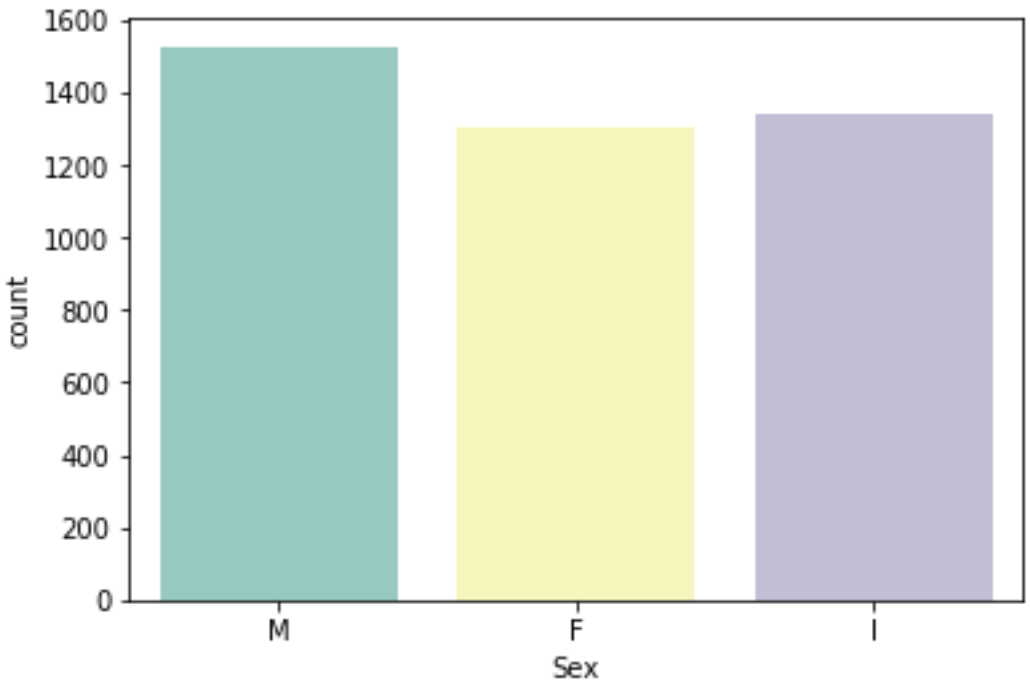
In[12]:
```
plt.figure(figsize = (20,7))
sns.heatmap(df[numerical_features].corr(),annot = True)
```

Out[12]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7fcc29714dd8>
```



In[13]:
```
sns.countplot(x = 'Sex', data = df, palette = 'Set3')
```

Out[13]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7fcc26ba6748>
```



Male : age majority lies in between 7.5 years to 19 years

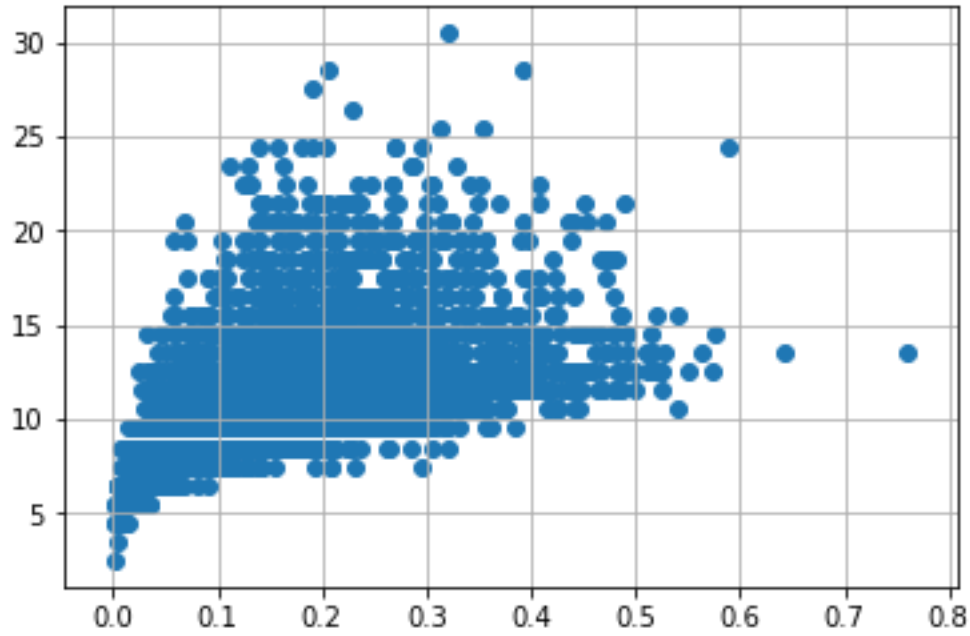
Female: age majority lies in between 8 years to 19 years

Immature: age majority lies in between 6 years to < 10 years

Data Preprocessing

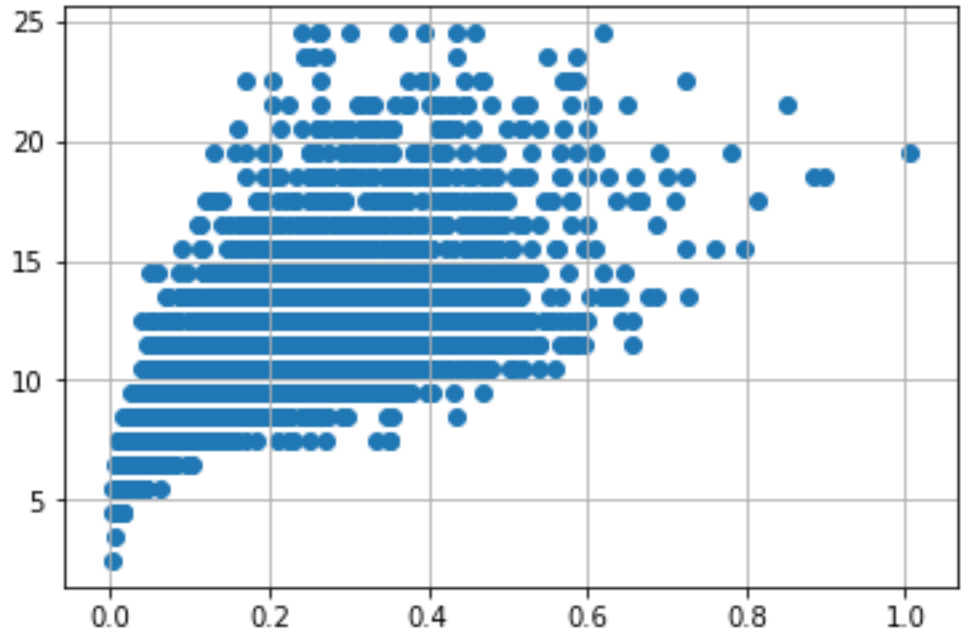
In [15]:
```
# outlier handling
df = pd.get_dummies(df)
dummy_df = df
```

In [16]:
```
var = 'Viscera weight'
plt.scatter(x = df[var], y = df['age'])
plt.grid(True)
```



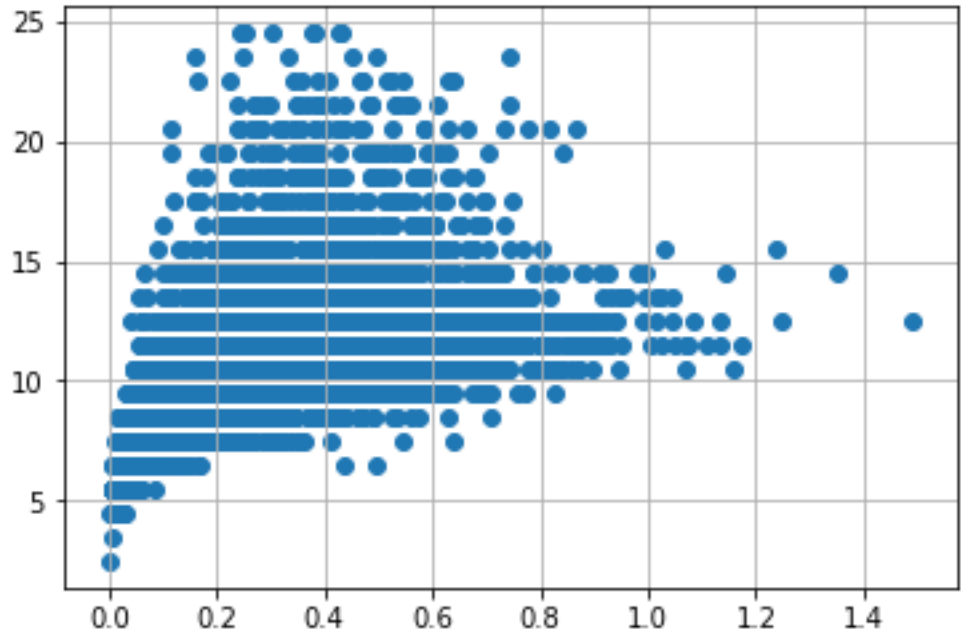

```
In[17]: df.drop(df[(df['Viscera weight'] > 0.5) &
          (df['age'] < 20)].index, inplace = True)
df.drop(df[(df['Viscera weight']<0.5) & (
df['age'] > 25)].index, inplace = True)
```

In [18]:
```
var = 'Shell weight'
plt.scatter(x = df[var], y = df['age'])
plt.grid(True)
```



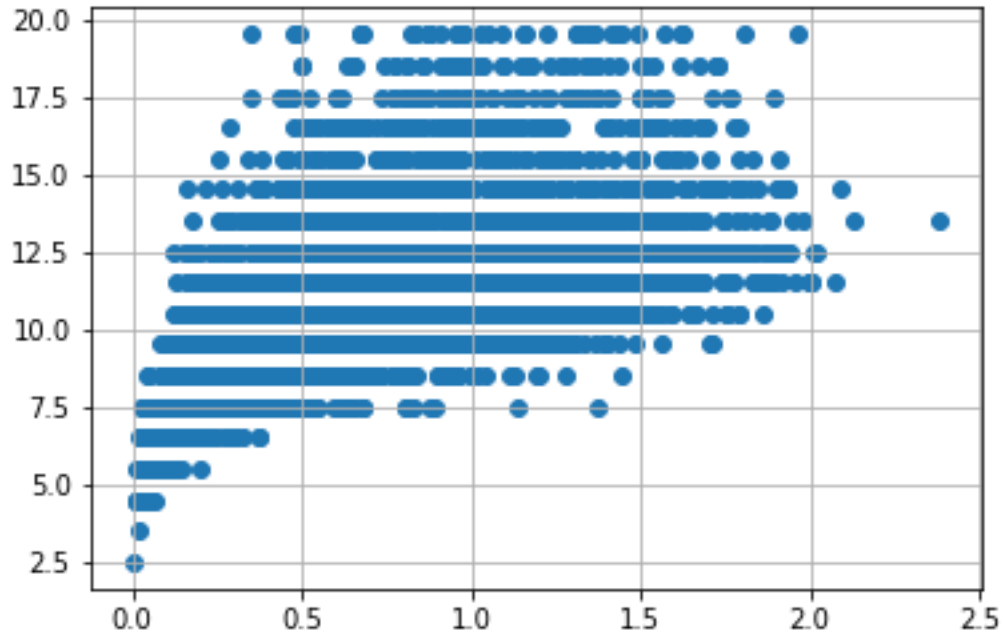

```
In[19]:df.drop(df[(df['Shell weight'] > 0.6) &
          (df['age'] < 25)].index, inplace = True)
       df.drop(df[(df['Shell weight']<0.8) & (
       df['age'] > 25)].index, inplace = True)
```

In [20]:
```
var = 'Shucked weight'
plt.scatter(x = df[var], y = df['age'])
plt.grid(True)
```



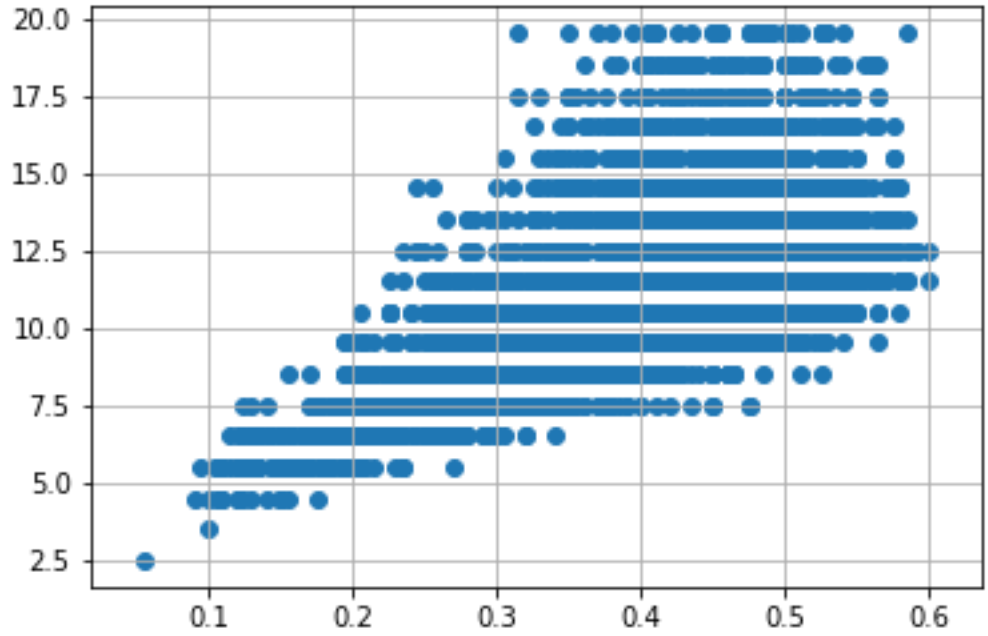
```
In[21]: df.drop(df[(df['Shucked weight'] >= 1) &
          (df['age'] < 20)].index, inplace = True)
        df.drop(df[(df['Viscera weight']<1) & (
        df['age'] > 20)].index, inplace = True)
```

```
In [22]: var = 'Whole weight'
         plt.scatter(x = df[var], y = df['age'])
         plt.grid(True)
```



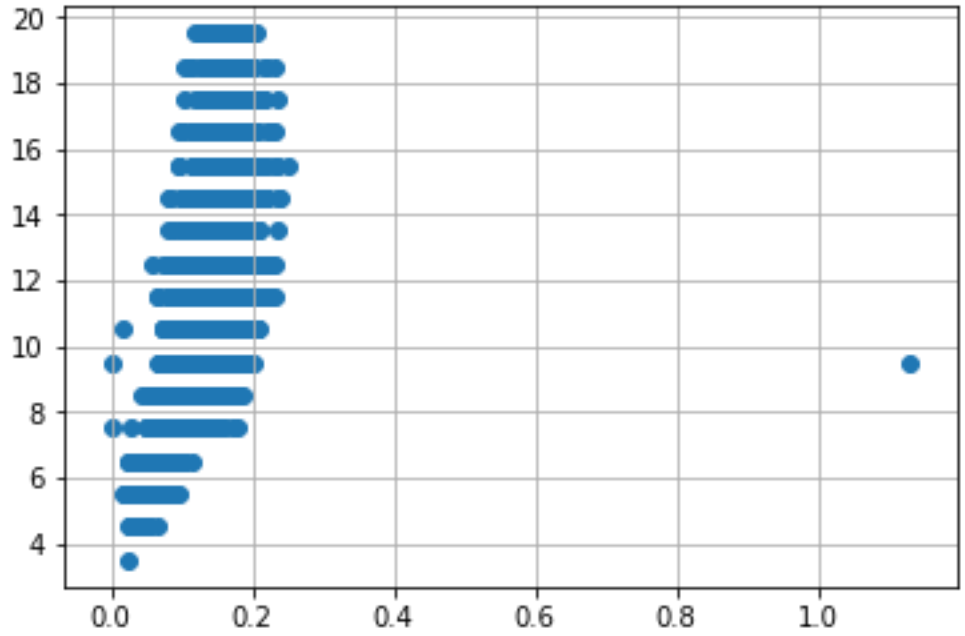

```
In[23]: df.drop(df[(df['Whole weight'] >= 2.5) &
          (df['age'] < 25)].index, inplace = True)
        df.drop(df[(df['Whole weight']<2.5) & (
        df['age'] > 25)].index, inplace = True)
```

```
In [24]: var = 'Diameter'
         plt.scatter(x = df[var], y = df['age'])
         plt.grid(True)
```



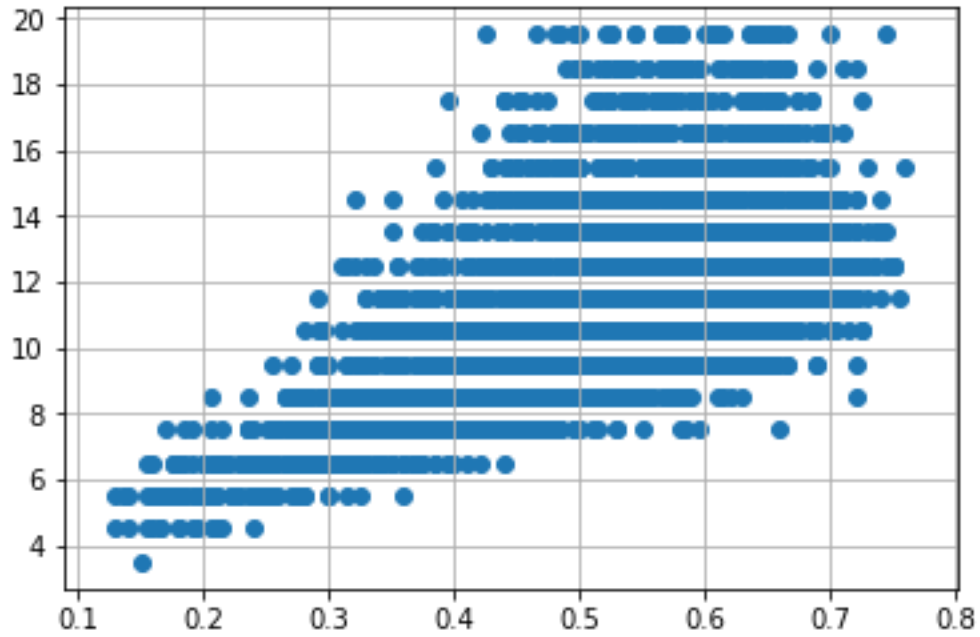

```
In[25]: df.drop(df[(df['Diameter'] <0.1) &
          (df['age'] < 5)].index, inplace = True)
        df.drop(df[(df['Diameter']<0.6) & (
        df['age'] > 25)].index, inplace = True)
        df.drop(df[(df['Diameter']>=0.6) & (
        df['age'] < 25)].index, inplace = True)
```

```
In [26]: var = 'Height'
         plt.scatter(x = df[var], y = df['age'])
         plt.grid(True)
```




```
In[27]:df.drop(df[(df['Height'] > 0.4) &
          (df['age'] < 15)].index, inplace = True)
       df.drop(df[(df['Height']<0.4) & (
       df['age'] > 25)].index, inplace = True)
```

In [28]:
```
var = 'Length'
plt.scatter(x = df[var], y = df['age'])
plt.grid(True)
```



In[29]:
```
df.drop(df[(df['Length'] <0.1) &
          (df['age'] < 5)].index, inplace = True)
        df.drop(df[(df['Length']<0.8) & (
        df['age'] > 25)].index, inplace = True)
        df.drop(df[(df['Length']>=0.8) & (
        df['age'] < 25)].index, inplace = True)
```

Feature Selection and Standardization

In [30]:
```
X = df.drop('age', axis = 1)
y = df['age']
```

In [31]:
```
from sklearn.preprocessing import StandardScaler
from sklearn.model_selection import train_test_split, cross_val_score
from sklearn.feature_selection import SelectKBest
```

In [32]:
```
standardScale = StandardScaler()
standardScale.fit_transform(X)

selectkBest = SelectKBest()
X_new = selectkBest.fit_transform(X, y)

X_train, X_test, y_train, y_test = train_test_split(X_new, y, test_size =
0.25)
```

```
/opt/conda/lib/python3.6/site-packages/sklearn/preprocessing/data.py:645:
DataConversionWarning: Data with input dtype uint8, float64 were all
converted to float64 by StandardScaler.
  return self.partial_fit(X, y)
/opt/conda/lib/python3.6/site-packages/sklearn/base.py:464:
DataConversionWarning: Data with input dtype uint8, float64 were all
converted to float64 by StandardScaler.
```

Model Selection

1)Linear regression

In [33]:
```
from sklearn.linear_model import LinearRegression
```

In [34]:
```
lm = LinearRegression()
lm.fit(X_train, y_train)
```

Out[34]:
```
LinearRegression(copy_X=True, fit_intercept=True, n_jobs=None,
         normalize=False)
```

In [35]:
```
y_train_pred = lm.predict(X_train)
y_test_pred = lm.predict(X_test)
```

In [36]:
```
from sklearn.metrics import mean_absolute_error, mean_squared_error
```

```
s = mean_squared_error(y_train, y_train_pred)
print('Mean Squared error of training set :%2f'%s)

p = mean_squared_error(y_test, y_test_pred)
print('Mean Squared error of testing set :%2f'%p)
```

```
Mean Squared error of training set :3.551893
Mean Squared error of testing set :3.577687
```

In [37]:

```
from sklearn.metrics import r2_score
s = r2_score(y_train, y_train_pred)
print('R2 Score of training set:%.2f'%s)

p = r2_score(y_test, y_test_pred)
print('R2 Score of testing set:%.2f'%p)
```

```
 return self.fit(X, **fit_params).transform(X)


R2 Score of training set:0.54
R2 Score of testing set:0.53
```

2)Ridge

In [38]:
```
from sklearn.linear_model import Ridge
```

In [39]:

```
ridge_mod = Ridge(alpha=0.01, normalize=True)
ridge_mod.fit(X_train, y_train)
ridge_mod.fit(X_test, y_test)
ridge_model_pred = ridge_mod.predict(X_test)
ridge_mod.score(X_train, y_train)
```

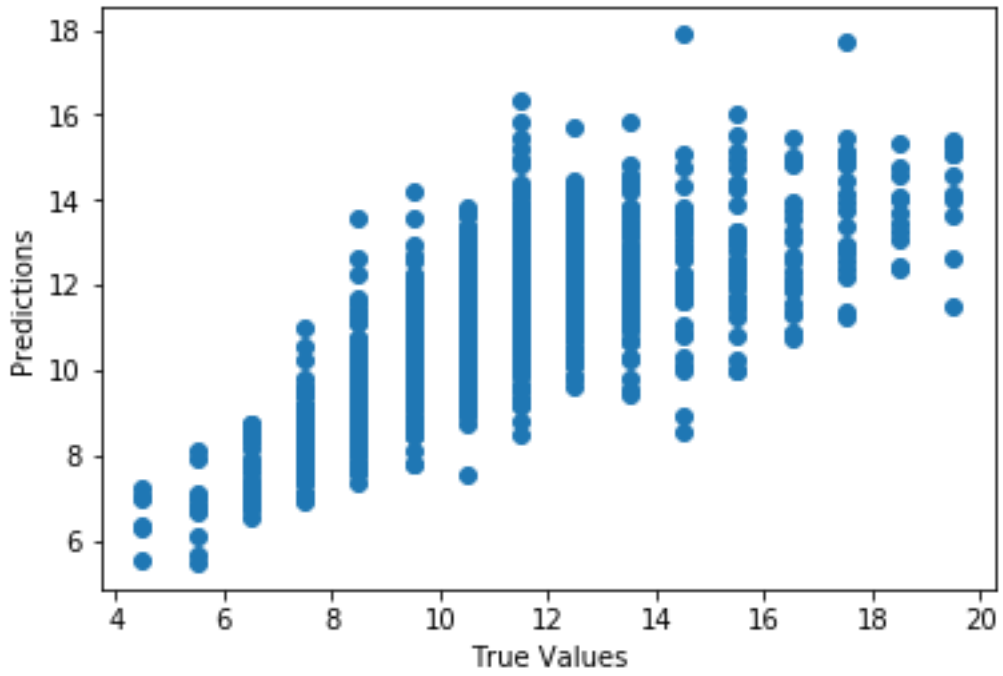
Out[39]:
```
0.5307346478347332
```

In [40]:
```
ridge_mod.score(X_test, y_test)
```

Out[40]:
```
0.5272608729607438
```

In [41]:
```
plt.scatter(y_test, ridge_model_pred)
      plt.xlabel('True Values')
      plt.ylabel('Predictions')
```

Out[41]:
```
Text(0, 0.5, 'Predictions')
```



3) RandomForestRegression

In [46]:
```
from sklearn.ensemble import RandomForestRegressor
```

In [47]:
```
regr = RandomForestRegressor(max_depth=2, random_state=0,
                             n_estimators=100)
```

In [48]:
```
regr.fit(X_train, y_train)
regr.fit(X_test, y_test)
```

Out[48]:
```
RandomForestRegressor(bootstrap=True, criterion='mse', max_depth=2,
           max_features='auto', max_leaf_nodes=None,
           min_impurity_decrease=0.0, min_impurity_split=None,
           min_samples_leaf=1, min_samples_split=2,
           min_weight_fraction_leaf=0.0, n_estimators=100, n_jobs=None,
           oob_score=False, random_state=0, verbose=0, warm_start=False)
```

In [49]:
```
y_train_pred = regr.predict(X_train)
y_test_pred = regr.predict(X_test)
regr.score(X_train, y_train)
```

Out[49]: `0.4287379777803546`

In [50]:
```
regr.score(X_test, y_test)
```

Out[50]: `0.43753106247261264`