Module 3 Lab 2 Solution

1. Load the dataset bike_day_raw.csv, which has the regression target cnt. This dataset is hourly bike rentals in the citybike platform. The cnt column is the number of rentals, which we want to predict from date and weather data.

- Split the data into a training and a test set using train_test_split.
- Use the LinearRegression class to learn a regression model on this data.
- You can evaluate with the score method, which provides the R^2or using the mean_squared_error function from sklearn.metrics (Challenge: You can also write it yourself in numpy).

In [3]:

```
import pandas as pd
from sklearn.model_selection import train_test_split

data = pd.read_csv("bike_day_raw.csv")
X = data.drop("cnt", axis=1)
y = data.cnt

display(data.head())

X_train, X_test, y_train, y_test = train_test_split(X, y, random_state=0)
```

	season	mnth	holiday	weekday	workingday	weathersit	temp	atemp	hum	w
0	1	1	0	6	0	2	0.344167	0.363625	0.805833	
1	1	1	0	0	0	2	0.363478	0.353739	0.696087	
2	1	1	0	1	1	1	0.196364	0.189405	0.437273	
3	1	1	0	2	1	1	0.200000	0.212122	0.590435	
4	1	1	0	3	1	1	0.226957	0.229270	0.436957	

In [4]:

```
from sklearn.linear_model import LinearRegression
import numpy

lr = LinearRegression().fit(X_train, y_train)

print(lr.score(X_train, y_train))
ybar = numpy.sum(y_train)/len(y_train)          # or sum(y)/len(y)
ssreg = numpy.sum((lr.predict(X_train)-ybar)**2)    # or sum([ (yihat - ybar)*
sstot = numpy.sum((y_train - ybar)**2)    # or sum([ (yi - ybar)**2 for yi in
print(ssreg / sstot)

print(lr.score(X_test, y_test))
```

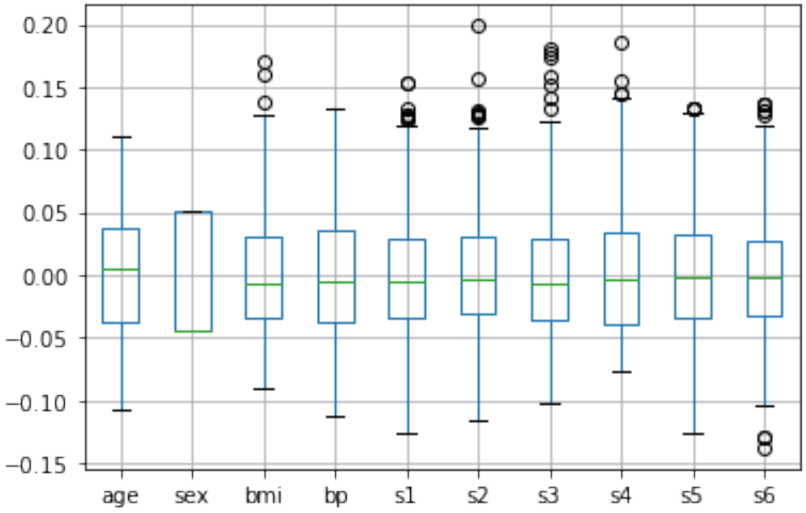
```
0.5328925529498699
0.5328925529498698
0.4991033756876271
```

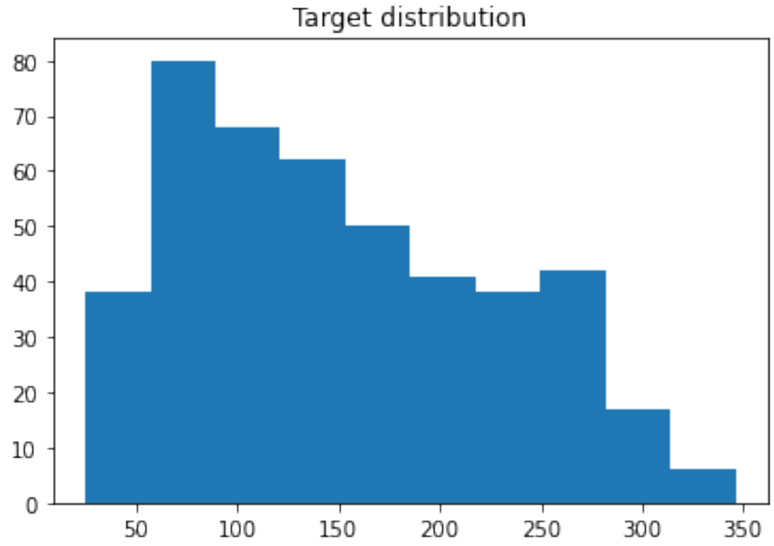
1. Load the diabetes dataset using sklearn.datasets.load_diabetes.

- Scale the dataset (you can be creative and make pipelines)
- Apply LinearRegression,
- Apply Ridge and do grid search
- Apply Lasso and do grid search
- Visualize the coefficients.

In [5]:

```
from sklearn.linear_model import Lasso, Ridge, LinearRegression
from sklearn.model_selection import train_test_split, cross_val_score
from sklearn.datasets import load_diabetes
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt

diabetes = load_diabetes()

# create dataframe for easy boxplot
df = pd.DataFrame(diabetes.data, columns=diabetes.feature_names)
df.boxplot()

plt.figure()
plt.title("Target distribution")
plt.hist(diabetes.target, bins="auto")

X_train, X_test, y_train, y_test = train_test_split(diabetes.data,
                                                    diabetes.target)
```



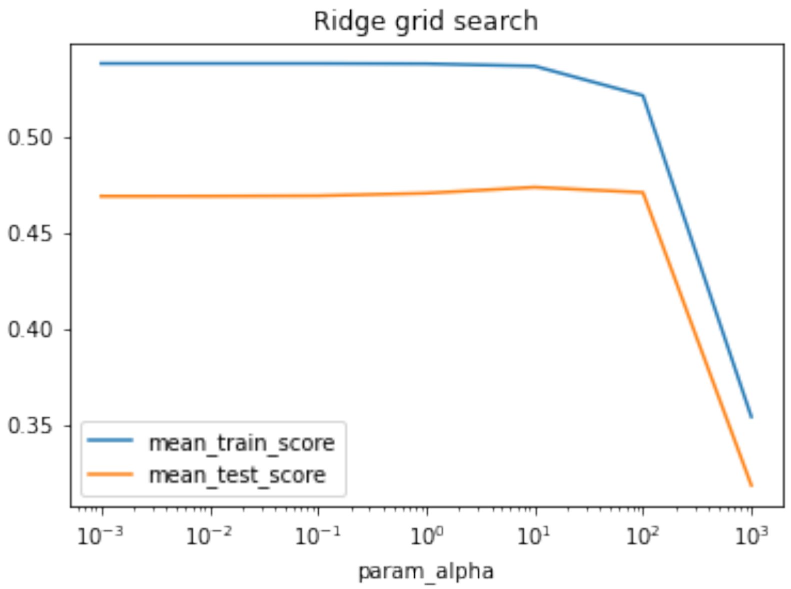


In [6]:

```
# With scaled data
from sklearn.preprocessing import StandardScaler
scaler = StandardScaler().fit(X_train)
X_train_scaled = scaler.transform(X_train)
X_test_scaled = scaler.transform(X_test)

scores_lr = cross_val_score(LinearRegression(), X_train_scaled, y_train, cv=1
print("Linear regression w/ scaling:", scores_lr.mean())
scores_ridge = cross_val_score(Ridge(), X_train_scaled, y_train, cv=10)
print("Ridge regression w/ scaling:", scores_ridge.mean())

from sklearn.model_selection import GridSearchCV
param_grid = {'alpha': np.logspace(-3, 3, 7)}
grid = GridSearchCV(Ridge(), param_grid, cv=10, return_train_score=True)
grid.fit(X_train_scaled, y_train)

res = pd.DataFrame(grid.cv_results_)
res.plot("param_alpha", ["mean_train_score", "mean_test_score"], logx=True)
plt.title("Ridge grid search")
```

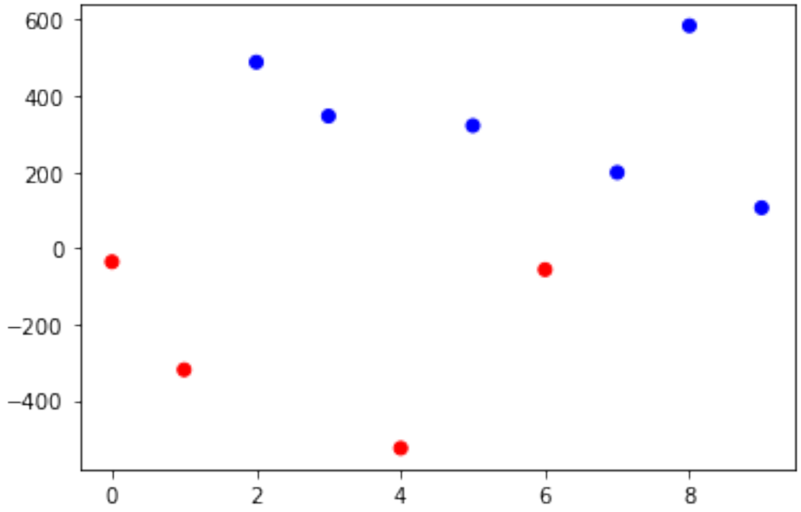
```
Linear regression w/ scaling: 0.46894845696632537
Ridge regression w/ scaling: 0.47052967021791836
```

Out[6]:
```
Text(0.5, 1.0, 'Ridge grid search')
```

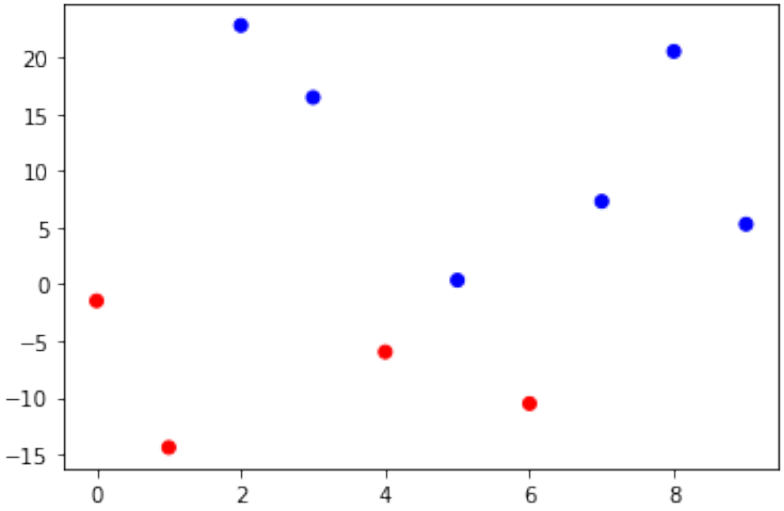


In [7]:
```
lr = LinearRegression().fit(X_train, y_train)
plt.scatter(range(X_train.shape[1]), lr.coef_, c=np.sign(lr.coef_), cmap="bwr
```

Out[7]:
```
<matplotlib.collections.PathCollection at 0x1227edb20>
```



In [8]:
```
ridge = grid.best_estimator_
plt.scatter(range(X_train.shape[1]), ridge.coef_, c=np.sign(ridge.coef_), cma
Out[8]: <matplotlib.collections.PathCollection at 0x1219131c0>
```



```
In [9]: param_grid = {'alpha': np.logspace(-3, 0, 13)}
        print(param_grid)
```

```
{'alpha': array([0.001     , 0.00177828, 0.00316228, 0.00562341, 0.01      ,
       0.01778279, 0.03162278, 0.05623413, 0.1       , 0.17782794,
       0.31622777, 0.56234133, 1.        ])}
```

```
In [10]: grid = GridSearchCV(Lasso(normalize=True, max_iter=1e6), param_grid, cv=10, r
         grid.fit(X_train, y_train)
```

```
/Users/gceran/opt/anaconda3/lib/python3.8/site-packages/sklearn/model_selectio
n/_search.py:847: FutureWarning: The parameter 'iid' is deprecated in 0.22 and
will be removed in 0.24.
  warnings.warn(
```

```
Out[10]: GridSearchCV(cv=10, estimator=Lasso(max_iter=1000000.0, normalize=True),
                      iid=False,
                      param_grid={'alpha': array([0.001     , 0.00177828, 0.00316228, 0
.00562341, 0.01      ,
       0.01778279, 0.03162278, 0.05623413, 0.1       , 0.17782794,
       0.31622777, 0.56234133, 1.        ])},
                      return_train_score=True)
```

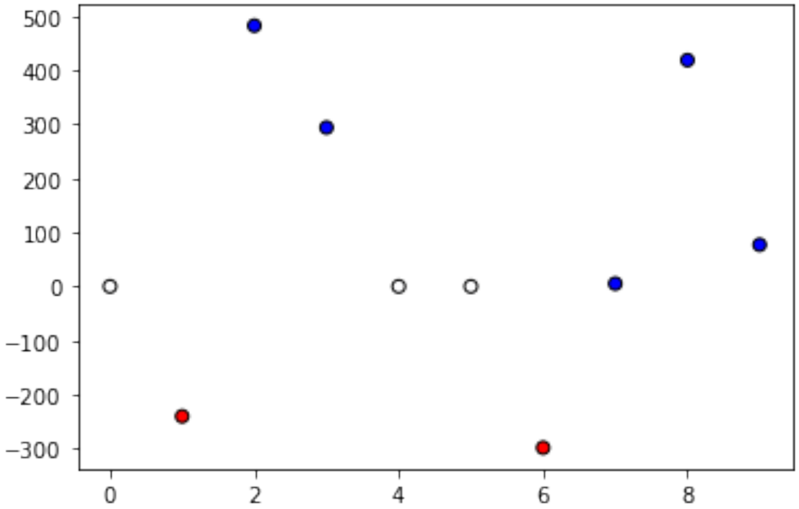
```
In [11]: print(grid.best_params_)
         print(grid.best_score_)
```

```
{'alpha': 0.1}
0.47667873696118457
```

```
In [12]: grid.score(X_test, y_test)
```

```
Out[12]: 0.43083075264606996
```

```
In [13]: lasso = grid.best_estimator_
         plt.scatter(range(X_train.shape[1]), lasso.coef_, c=np.sign(lasso.coef_), cma
Out[13]: <matplotlib.collections.PathCollection at 0x1218f5b80>
```



```
In [ ]:
```