In [6]:

```python
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
from sklearn import preprocessing,svm
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn.preprocessing import StandardScaler
```

In [7]:

```
df=pd.read_csv(r"C:\Users\Welcome\Documents\bottle1.csv")
df
```

```
C:\Users\Welcome\AppData\Local\Temp\ipykernel_6724\3464836710.py:1: DtypeWarn
ing: Columns (47,73) have mixed types. Specify dtype option on import or set
low_memory=False.
  df=pd.read_csv(r"C:\Users\Welcome\Documents\bottle1.csv")
```

Out[7]:

	Cst_Cnt	Btl_Cnt	Sta_ID	Depth_ID	Depthm	T_degC	Salnty	O2ml_L	STheta	O2Sa
0	1	1	054.0 056.0	19-4903CR-HY-060-0930-05400560-0000A-3	0	10.500	33.4400	NaN	25.64900	Na
1	1	2	054.0 056.0	19-4903CR-HY-060-0930-05400560-0008A-3	8	10.460	33.4400	NaN	25.65600	Na
2	1	3	054.0 056.0	19-4903CR-HY-060-0930-05400560-0010A-7	10	10.460	33.4370	NaN	25.65400	Na
3	1	4	054.0 056.0	19-4903CR-HY-060-0930-05400560-0019A-3	19	10.450	33.4200	NaN	25.64300	Na
4	1	5	054.0 056.0	19-4903CR-HY-060-0930-05400560-0020A-7	20	10.450	33.4210	NaN	25.64300	Na
...	...	...	...	...	...	...	...	...	...	.
864858	34404	864859	093.4 026.4	20-1611SR-MX-310-2239-09340264-0000A-7	0	18.744	33.4083	5.805	23.87055	108.7
864859	34404	864860	093.4 026.4	20-1611SR-MX-310-2239-09340264-0002A-3	2	18.744	33.4083	5.805	23.87072	108.7
864860	34404	864861	093.4 026.4	20-1611SR-MX-310-2239-09340264-0005A-3	5	18.692	33.4150	5.796	23.88911	108.4
864861	34404	864862	093.4 026.4	20-1611SR-MX-310-2239-09340264-0010A-3	10	18.161	33.4062	5.816	24.01426	107.7

	Cst_Cnt	Btl_Cnt	Sta_ID	Depth_ID	Depthm	T_degC	Salnty	O2ml_L	STheta	O2Sa
864862	34404	864863	093.4 026.4	20-1611SR-MX-310-2239-09340264-0015A-3	15	17.533	33.3880	5.774	24.15297	105.6

864863 rows × 74 columns

In [11]:

```
df=df[['Salnty','T_degC']]
df.columns=['sal','temp']
```

In [12]:

```
df.head(10)
```

Out[12]:

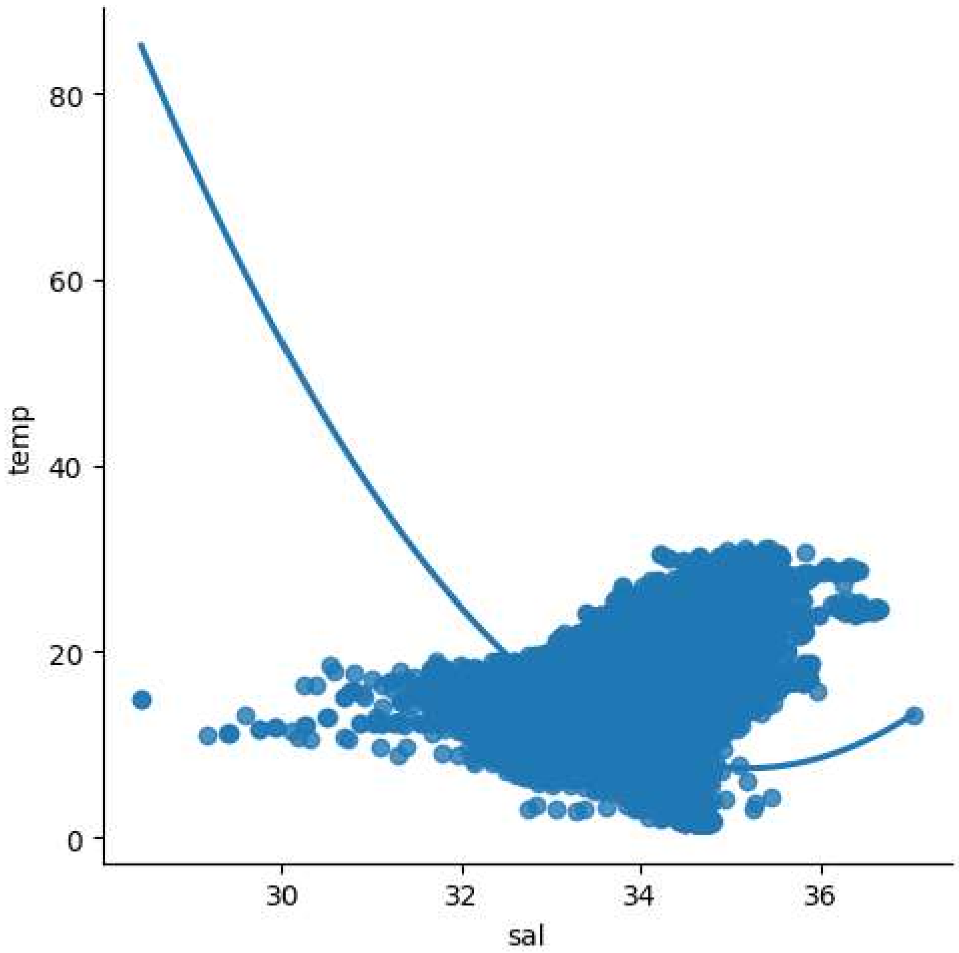
	sal	temp
0	33.440	10.50
1	33.440	10.46
2	33.437	10.46
3	33.420	10.45
4	33.421	10.45
5	33.431	10.45
6	33.440	10.45
7	33.424	10.24
8	33.420	10.06
9	33.494	9.86

In [13]:

```
sns.lmplot(x='sal',y='temp',data=df,order=2,ci=None)
```

Out[13]:

```
<seaborn.axisgrid.FacetGrid at 0x176ab76f010>
```



In [14]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 864863 entries, 0 to 864862
Data columns (total 2 columns):
 #   Column  Non-Null Count   Dtype  
---  ------  --------------   -----  
 0   sal     817509 non-null  float64
 1   temp    853900 non-null  float64
dtypes: float64(2)
memory usage: 13.2 MB
```

In [15]:

```python
df.describe()
```

Out[15]:

	sal	temp
count	817509.000000	853900.000000
mean	33.840350	10.799677
std	0.461843	4.243825
min	28.431000	1.440000
25%	33.488000	7.680000
50%	33.863000	10.060000
75%	34.196900	13.880000
max	37.034000	31.140000

In [16]:

```python
df.fillna(method='ffill')
```

Out[16]:

	sal	temp
0	33.4400	10.500
1	33.4400	10.460
2	33.4370	10.460
3	33.4200	10.450
4	33.4210	10.450
...	...	...
864858	33.4083	18.744
864859	33.4083	18.744
864860	33.4150	18.692
864861	33.4062	18.161
864862	33.3880	17.533

864863 rows × 2 columns

In [17]:

```python
df.fillna(value=0,inplace=True)
```

In [18]:

```python
df.isnull().sum()
```

Out[18]:

```
sal     0
temp    0
dtype: int64
```

In [19]:

```python
x=np.array(df['sal']).reshape(-1,1)
y=np.array(df['temp']).reshape(-1,1)
```

In [20]:

```
df.isna().any()
```

Out[20]:

```
sal      False
temp     False
dtype: bool
```

In [21]:

```
df.dropna(inplace=True)
```

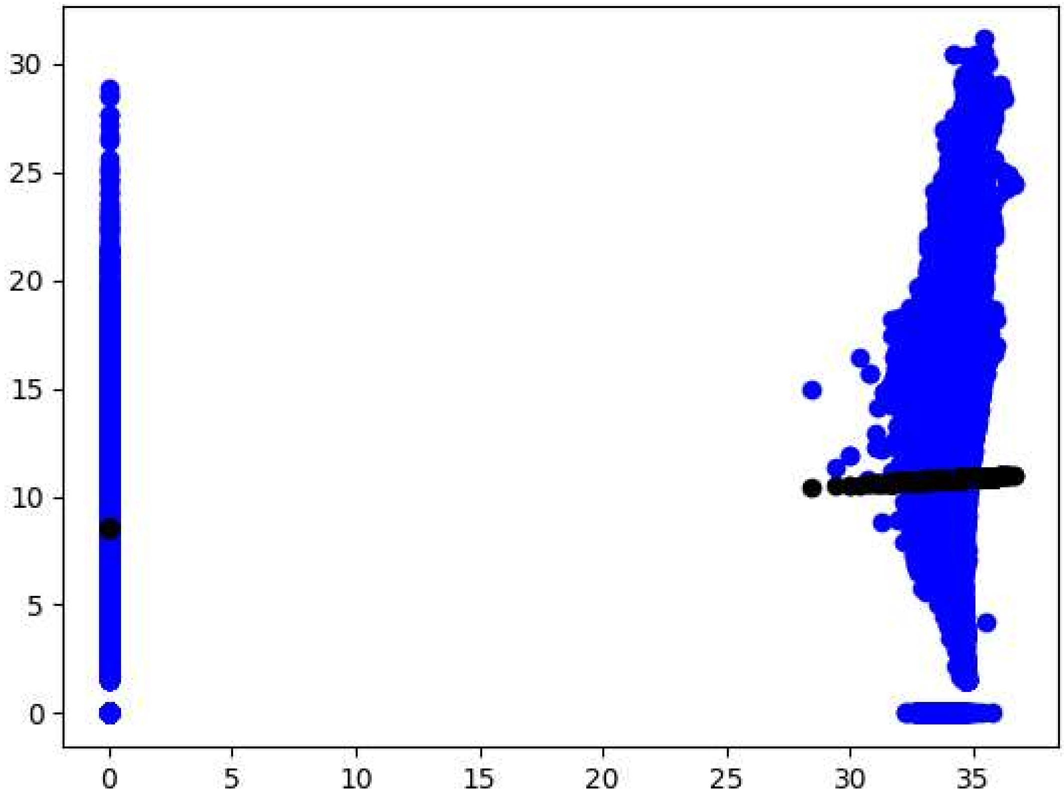
In [22]:

```
X_train,X_test,y_train,y_test=train_test_split(x,y,test_size=0.25)
reg=LinearRegression()
reg.fit(X_train,y_train)
print(reg.score(X_test,y_test))
```

```
0.014953114878132445
```

In [23]:

```
y_pred=reg.predict(X_test)
plt.scatter(X_test,y_test,color='b')
plt.scatter(X_test,y_pred,color='k')
plt.show()
```

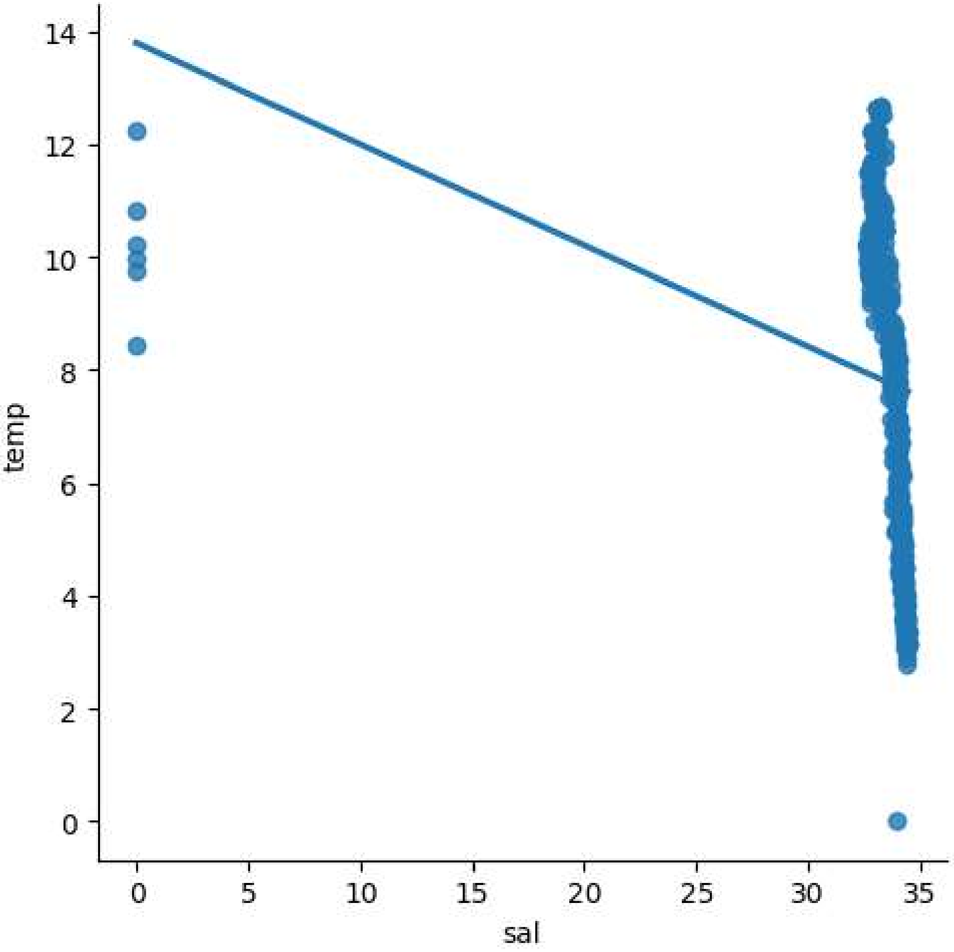


In [24]:

```
df500=df[:][:500]
sns.lmplot(x="sal",y="temp",data=df500,order=1,ci=None)
```

Out[24]:

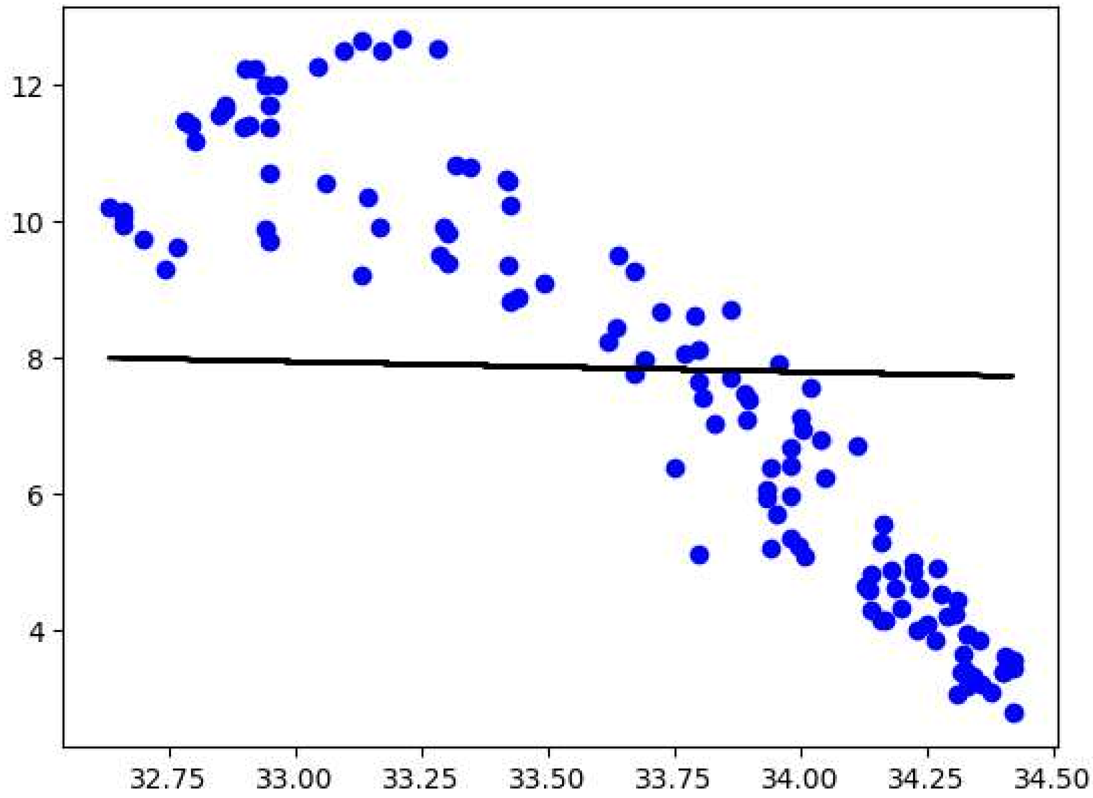
```
<seaborn.axisgrid.FacetGrid at 0x176ab76f040>
```



In [25]:

```
df500.fillna(method='ffill',inplace=True)
X=np.array(df500['sal']).reshape(-1,1)
y=np.array(df500['temp']).reshape(-1,1)
df500.dropna(inplace=True)
X_train,X_test,y_train,y_test=train_test_split(X,y,test_size=0.25)
reg=LinearRegression()
reg.fit(X_train,y_train)
print("Regression:",reg.score(X_test,y_test))
y_pred=reg.predict(X_test)
plt.scatter(X_test,y_test,color="b")
plt.plot(X_test,y_pred,color='k')
plt.show()
```

```
Regression: 0.042321355512622616
```



In [26]:

```
from sklearn.linear_model import LinearRegression
from sklearn.metrics import r2_score
mode1=LinearRegression()
mode1.fit(X_train,y_train)
y_pred=mode1.predict(X_test)
r2=r2_score(y_test,y_pred)
print("R2 score:",r2)
```

```
R2 score: 0.042321355512622616
```

conclusion:Linear Regression is best fit for the model

Ridge and Lasso Regression

In [27]:

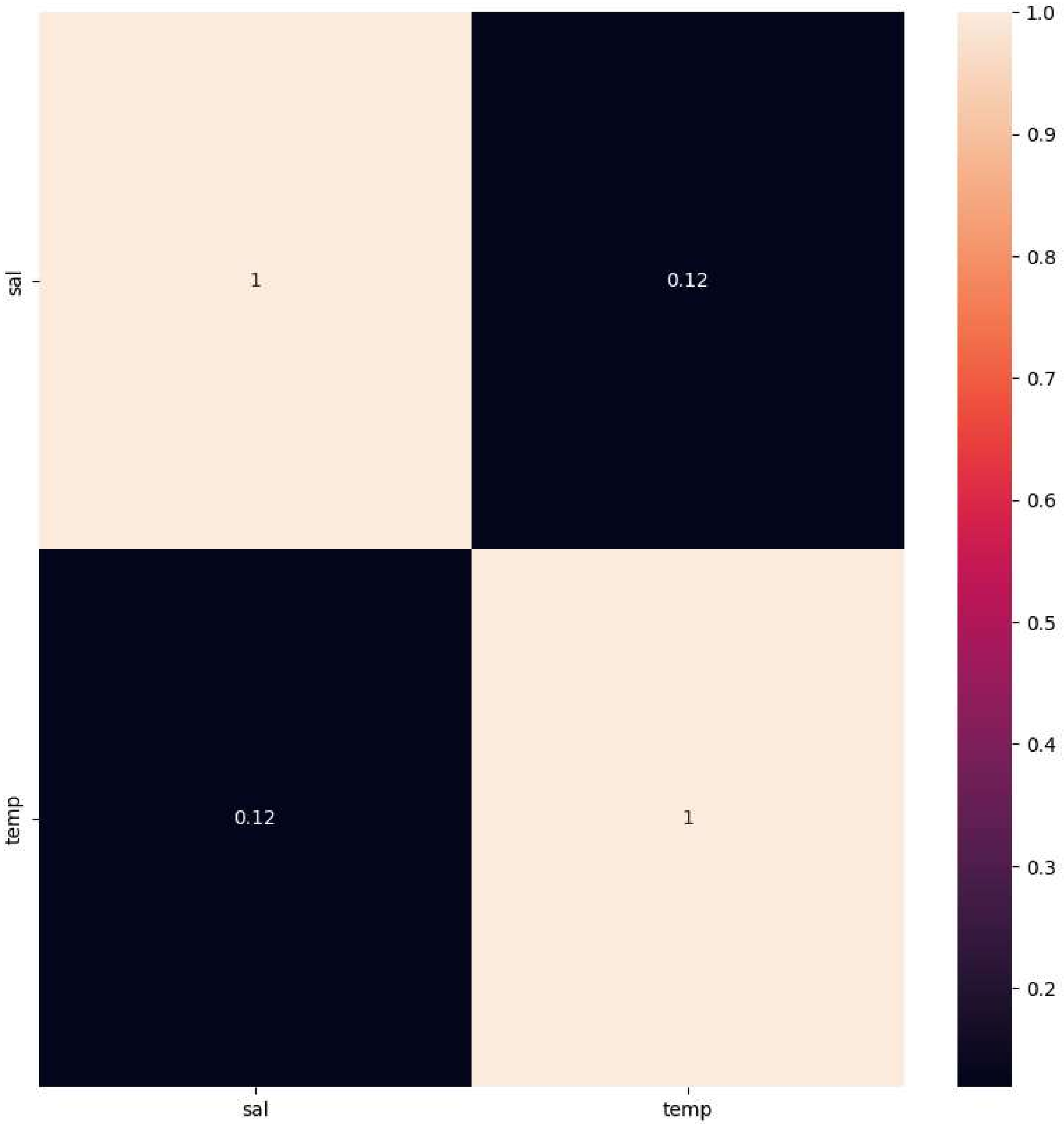
```
from sklearn.linear_model import Ridge
from sklearn.linear_model import RidgeCV
from sklearn.linear_model import Lasso
```

In [28]:

```
plt.figure(figsize = (10, 10))
sns.heatmap(df.corr(), annot = True)
```

Out[28]:

```
<Axes: >
```



In [29]:

```
features = df.columns[0:2]
target = df.columns[-1]
#X and y values
X = df[features].values
y = df[target].values
#splot
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.3, r
print("The dimension of X_train is {}".format(X_train.shape))
print("The dimension of X_test is {}".format(X_test.shape))
#Scale features
scaler = StandardScaler()
X_train = scaler.fit_transform(X_train)
X_test = scaler.transform(X_test)
```

```
The dimension of X_train is (605404, 2)
The dimension of X_test is (259459, 2)
```

In [30]:

```
lr = LinearRegression()
#Fit model
lr.fit(X_train, y_train)
#predict
#prediction = lr.predict(X_test)
#actual
actual = y_test
train_score_lr = lr.score(X_train, y_train)
test_score_lr = lr.score(X_test, y_test)
print("\nLinear Regression Model:\n")
print("The train score for lr model is {}".format(train_score_lr))
print("The test score for lr model is {}".format(test_score_lr))

```

```

Linear Regression Model:

The train score for lr model is 1.0
The test score for lr model is 1.0
```

In [31]:

```
ridgeReg = Ridge(alpha=10)
ridgeReg.fit(X_train,y_train)
#train and test scorefor ridge regression
train_score_ridge = ridgeReg.score(X_train, y_train)
test_score_ridge = ridgeReg.score(X_test, y_test)
print("\nRidge Model:\n")
print("The train score for ridge model is {}".format(train_score_ridge))
print("The test score for ridge model is {}".format(test_score_ridge))
```

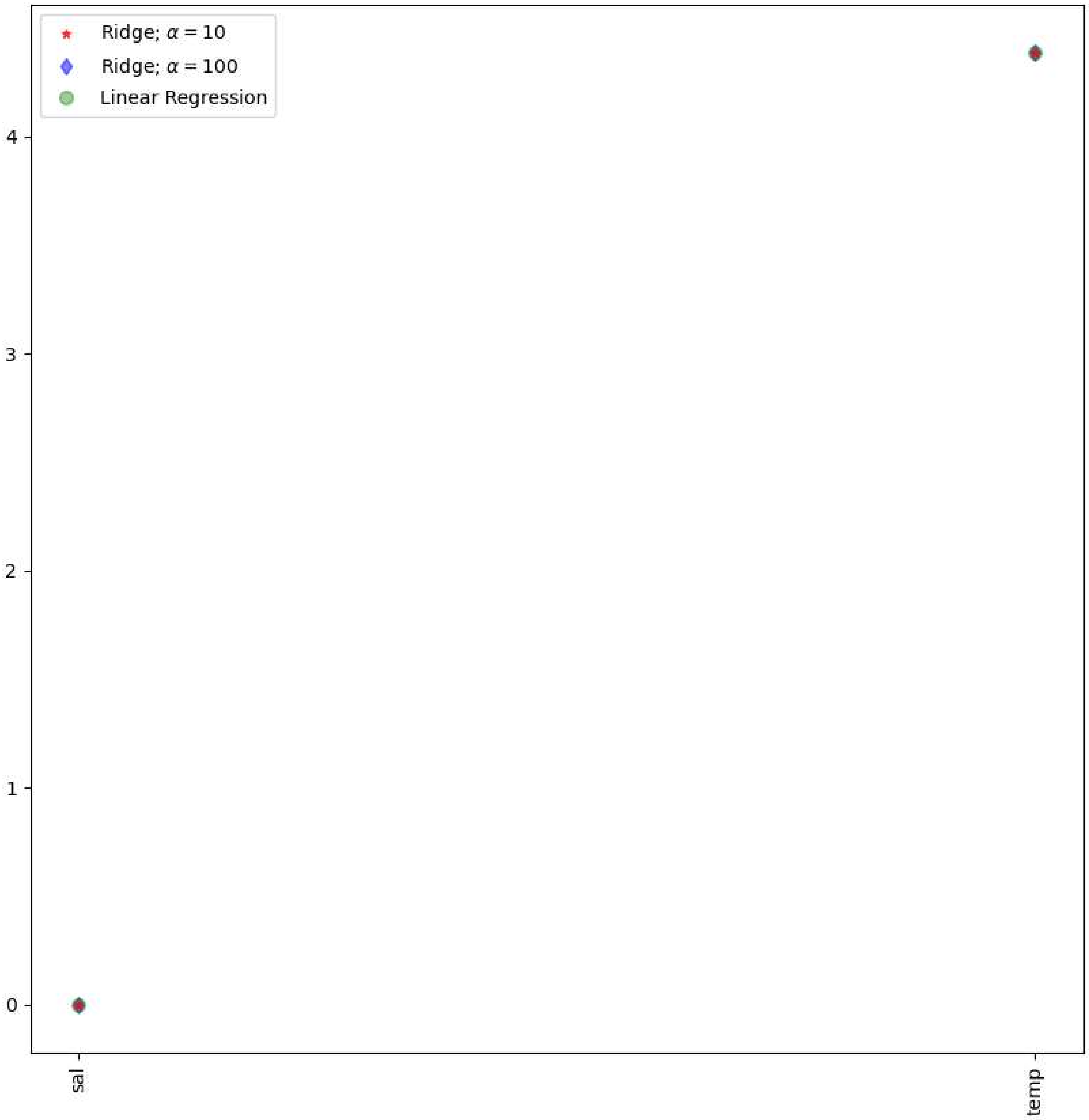
```

Ridge Model:

The train score for ridge model is 0.999999999723243
The test score for ridge model is 0.9999999997231402
```

In [32]:

```
plt.figure(figsize = (10, 10))
plt.plot(features,ridgeReg.coef_,alpha=0.7,linestyle='none',marker='*',mar
plt.plot(lr.coef_,alpha=0.5,linestyle='none',marker='d',markersize=6,color
plt.plot(features,lr.coef_,alpha=0.4,linestyle='none',marker='o',markersiz
plt.xticks(rotation = 90)
plt.legend()
plt.show()
```



In [33]:

```
print("\nLasso Model: \n")
lasso = Lasso(alpha = 10)
lasso.fit(X_train,y_train)
train_score_ls =lasso.score(X_train,y_train)
test_score_ls =lasso.score(X_test,y_test)
print("The train score for ls model is {}".format(train_score_ls))
print("The test score for ls model is {}".format(test_score_ls))
```

```

Lasso Model: 

The train score for ls model is 0.0
The test score for ls model is -1.9031696447013857e-05
```

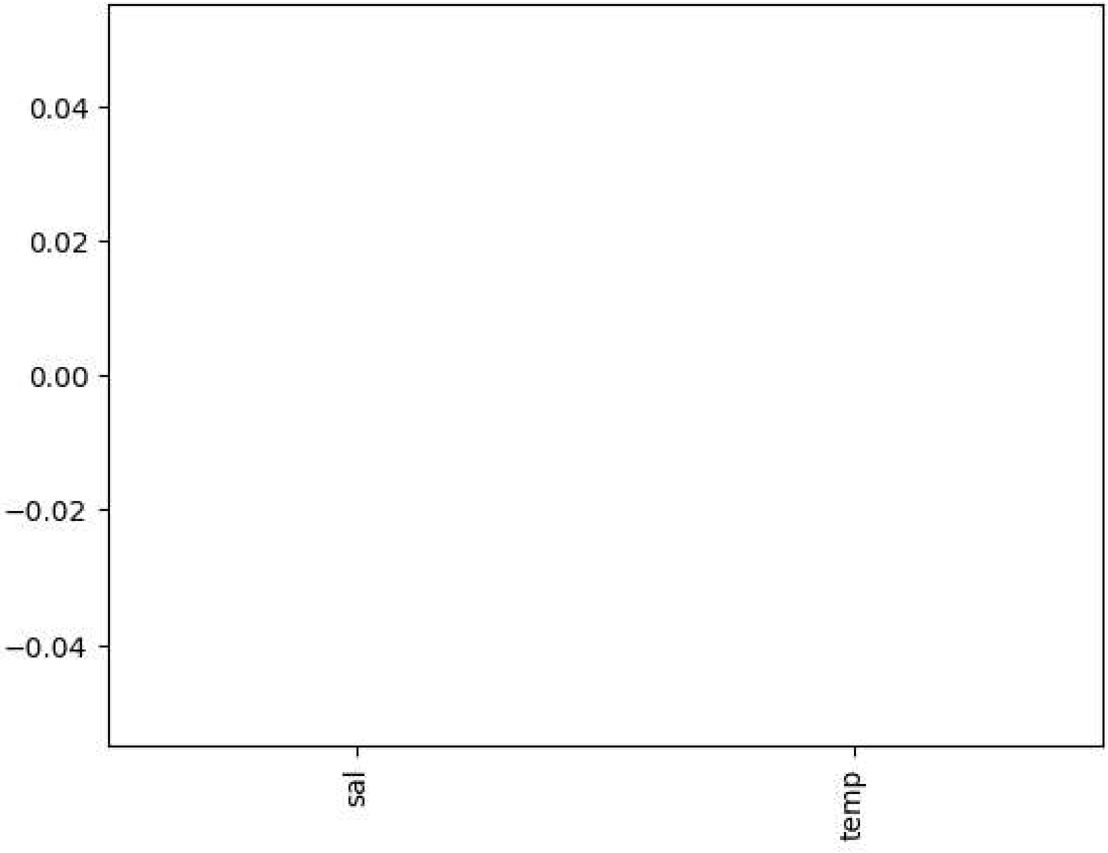
In [34]:

```
pd.Series(lasso.coef_, features).sort_values(ascending = True).plot(kind =

```

Out[34]:

```
<Axes: >
```



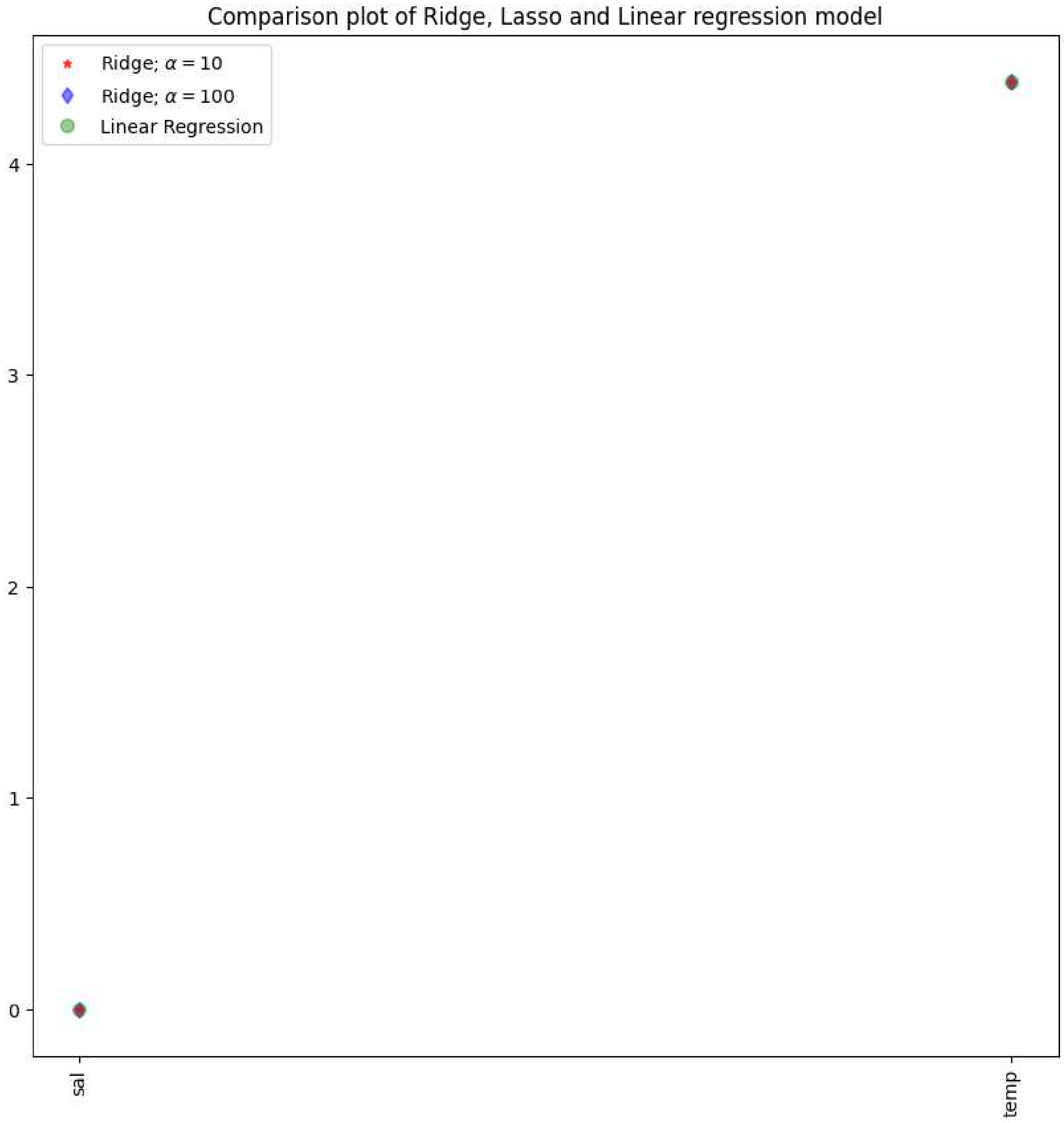
In [35]:

```
#Using the linear CV model
from sklearn.linear_model import LassoCV
#Lasso Cross validation
lasso_cv = LassoCV(alphas = [0.0001, 0.001,0.01, 0.1, 1, 10], random_state
#score
print(lasso_cv.score(X_train, y_train))
print(lasso_cv.score(X_test, y_test))
```

```
0.9999999994806811
0.9999999994806712
```

In [36]:

```
#plot size
plt.figure(figsize = (10, 10))
#add plot for ridge regression
plt.plot(features,ridgeReg.coef_,alpha=0.7,linestyle='none',marker='*',mar
#add plot for lasso regression
plt.plot(lasso_cv.coef_,alpha=0.5,linestyle='none',marker='d',markersize=6
#add plot for linear model
plt.plot(features,lr.coef_,alpha=0.4,linestyle='none',marker='o',markersiz
#rotate axis
plt.xticks(rotation = 90)
plt.legend()
plt.title("Comparison plot of Ridge, Lasso and Linear regression model")
plt.show()
```



In [37]:

```
#Using the linear CV model
from sklearn.linear_model import RidgeCV
#Ridge Cross validation
ridge_cv = RidgeCV(alphas = [0.0001, 0.001,0.01, 0.1, 1, 10]).fit(X_train,
#score
print("The train score for ridge model is {}".format(ridge_cv.score(X_trai
print("The train score for ridge model is {}".format(ridge_cv.score(X_test
```

```
The train score for ridge model is 0.9999999986797505
The train score for ridge model is 0.9999999986778121
```

In [38]:

```
from sklearn.linear_model import ElasticNet
regr=ElasticNet()
regr.fit(X,y)
print(regr.coef_)
print(regr.intercept_)

```

```
[0.         0.94934511]
0.5401219631067828
```