Homework 1

COMP9417, Machine Learning and Data Mining

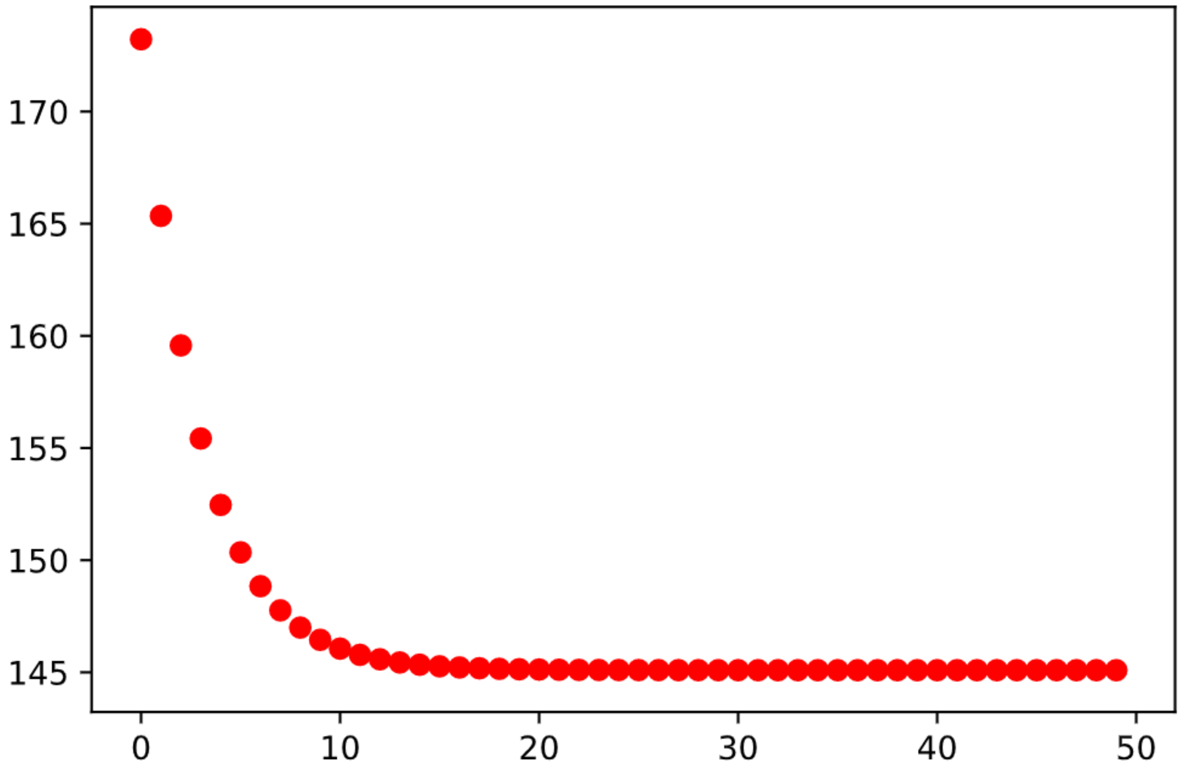
Author: Anant Krishna Mahale (z5277610)

1.The θ parameters (θ_0, θ_1;) from step 3 when you are using house age feature.

θ_0 is 42.54078538346594

θ_1 is -10.319399022339129

2. A plot, which visualises the change in cost function J(θ) at each iteration.



3. RMSE for your training set when you use house age feature.

RMSE for 'House_age' *training_data* 12.045510305912353

4. RMSE for test set, when you use house_age feature.

RMSE for 'House_age' *testing_data* 16.58731450340051

5. RMSE for test set, when you use distance to the station feature.

RMSE for 'Distance_to_Stataion' *testing data* 12.652088009723935

6.RMSE for test set, when you use number of stores feature

RMSE value while using 'Number of Stores' *testing data* 14.731993508206784

7.Compare the performance of your three models and rank them accordingly.

These are the different RMSE Values obtained from different features.

House Age

```
* Training: 12.045510305912353
* Testing: 16.58731450340051
```

Distance to the nearest MRT station

```
* Training: 9.165754538401488
* Testing: 12.652088009723935
```

Number of convenience stores

```
* Training: 27.486676129636784
* Testing: 25.642117651334722
```

We can see that, RMSE value for training data of “Number of convenience stores”> “House Age”> “Distance to the nearest MRT station”

Since training RMSE value for feature “Distance to the nearest MRT station” is least amongst all and order of magnitude for test and train data is same, I would rate it 1.

In the same terms, I would rank ‘House Age’ 2, and ‘Number of convenience stores’ 3 as it’s RMSE value is high among all the features.

Summary of the Rank:

1. Distance to the nearest MRT station
2. House Age
3. Number of convenience stores

In [1]:
```
#matplotlib inline
import matplotlib.pyplot as plt
import seaborn as sns
import pandas as pd
import numpy as np
import math
from sklearn import datasets,linear_model
from sklearn.metrics import mean_squared_error, r2_score
from sklearn.model_selection import train_test_split
```

In [2]:
```
#fucntion to calculate the square
def square(x):
    return x*x
```

In [3]:
```
def stocashtic_gradient_descent(X,y,theta0, theta1,learning_rate,iterations,col
or):
    m = len(y)
    for i in range(iterations):
        for j in range(m):
            h_x = theta0 + theta1 * X[j]
            theta0 = theta0 + learning_rate* (y[j] - h_x)
            theta1 = theta1 + learning_rate * (y[j] - h_x) * X[j]
        lossFn = sum([square(y[k] - theta0 - theta1*X[k]) for k in range(m)])/m
        #print(lossFn)
        plt.scatter(i, lossFn, c=color)
    return theta0, theta1
```

In [4]:
```
#Method to find the RMSE.
def findRMSE (X,y, theta0, theta1):
    m = len(y)
    sumSoFar = 0
    for i in range(m):
        currentSum = square(y[i] - theta0 - theta1 * X[i])
        sumSoFar = sumSoFar+currentSum
    sumSoFar = (1/m)*sumSoFar
    RMSE = math.sqrt(sumSoFar)

    return RMSE
```

In [5]:
```
# loading the housing_price_dataset from the current directory.
df=pd.read_csv('house_prices.csv')

#took each feature in the list.
features = ["house age","distance to the nearest MRT station", "number of conve
nience stores"]

#Normalization.
for feature in features:
    df[feature]=((df[feature]-df[feature].min())/(df[feature].max()-df[feature]
.min()))
```

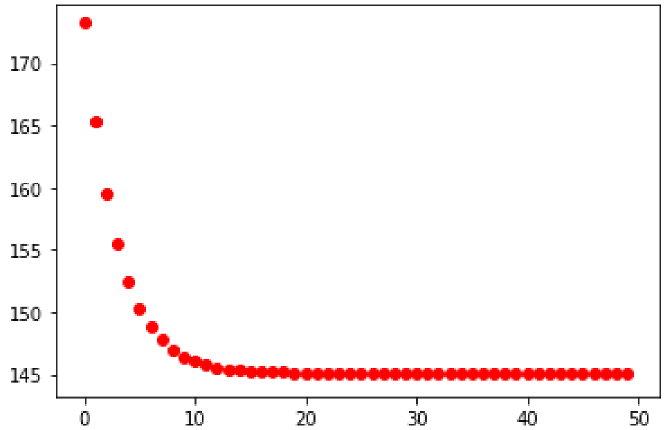
In [6]:
```
#Splitting Training and Test Data
trainData = df.iloc[:300]
testData = df.iloc[300:]
```

In [7]:
```
#decalring all the training data_set
train_housevalue = trainData['house price of unit area'].values
train_houseage = trainData['house age'].values
train_dist_to_store = trainData['distance to the nearest MRT station'].values
train_nbrOfStores = trainData['number of convenience stores'].values
```

In [8]:
```
#decalring all the test data_set
test_housevalue = testData['house price of unit area'].values
test_houseage = testData['house age'].values
test_dist_to_store = testData['distance to the nearest MRT station'].values
test_nbrOfStores = testData['number of convenience stores'].values
```

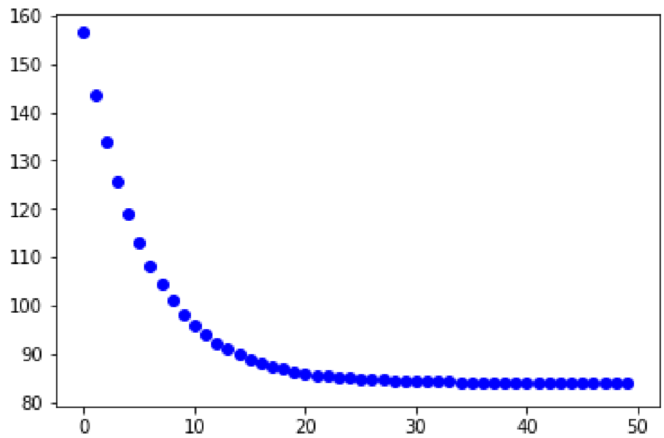
In [9]:
```
#intializing the parameters for training the model on House Age Values.
#Question 1- 4
init_theta0 = -1
init_theta1 = -0.5
learningRate = 0.01
maxIteration = 50

trained_theta0_ha, trained_theta1_ha = stocashtic_gradient_descent(train_housea
ge,train_housevalue,init_theta0,init_theta1,learningRate,maxIteration,'red')

train_RMSE_ha = findRMSE(train_houseage, train_housevalue, trained_theta0_ha, t
rained_theta1_ha)
test_RMSE_ha = findRMSE(test_houseage, test_housevalue, trained_theta0_ha, trai
ned_theta1_ha)

print('--------------------------*Values obtained on House Age Feature*--------
------------------\n')

print(f'Theta_0: {trained_theta0_ha}')
print(f'\nTheta_1: {trained_theta1_ha}')

#plt.show()

print('\nRMSE value for training data',train_RMSE_ha)
print('\nRMSE value for testing data',test_RMSE_ha)
```

```
--------------------------*Values obtained on House Age Feature*--------------
------------

Theta_0: 42.54078538346594

Theta_1: -10.319399022339129

RMSE value for training data 12.045510305912353

RMSE value for testing data 16.58731450340051
```



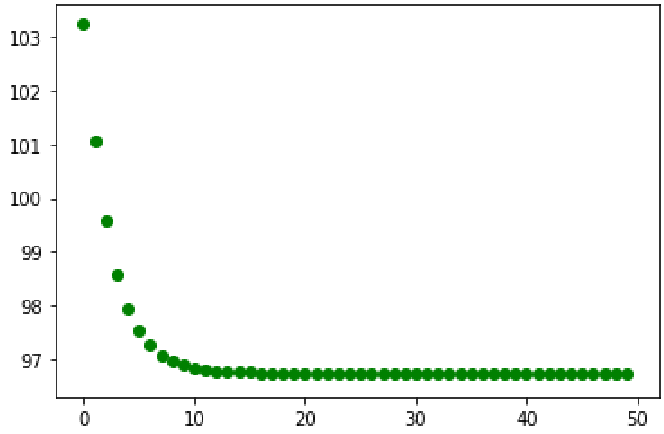
In [10]:
```
#Initializing the paramenters for training the model based on the distance to t
he station.
#Question_5
init_theta0 = -1
init_theta1 = -0.5
learningRate = 0.01
maxIteration = 50

trained_theta0_ds, trained_theta1_ds = stocashtic_gradient_descent(train_dist_t
o_store,train_housevalue,init_theta0,init_theta1,learningRate,maxIteration,'blu
e')
#plt.show()
train_RMSE_ds = findRMSE(train_dist_to_store, train_housevalue, trained_theta0_
ds, trained_theta1_ds)
test_RMSE_ds = findRMSE(test_dist_to_store, test_housevalue, trained_theta0_ds,
trained_theta1_ds)

print('-------------------------*Values obtained on \'Distance to the nearest M
RT station Feature\'*-------------------------\n')

print(f'Theta_0: {trained_theta0_ds}')
print(f'\nTheta_1: {trained_theta1_ds}')

print('\nRMSE value for training data',train_RMSE_ds)
print('\nRMSE value for testing data',test_RMSE_ds)
```

```
-------------------------*Values obtained on 'Distance to the nearest MRT stat
ion Feature'*-------------------------

Theta_0: 44.766087037899375

Theta_1: -46.500633970906314

RMSE value for training data 9.165754538401488

RMSE value for testing data 12.652088009723935
```



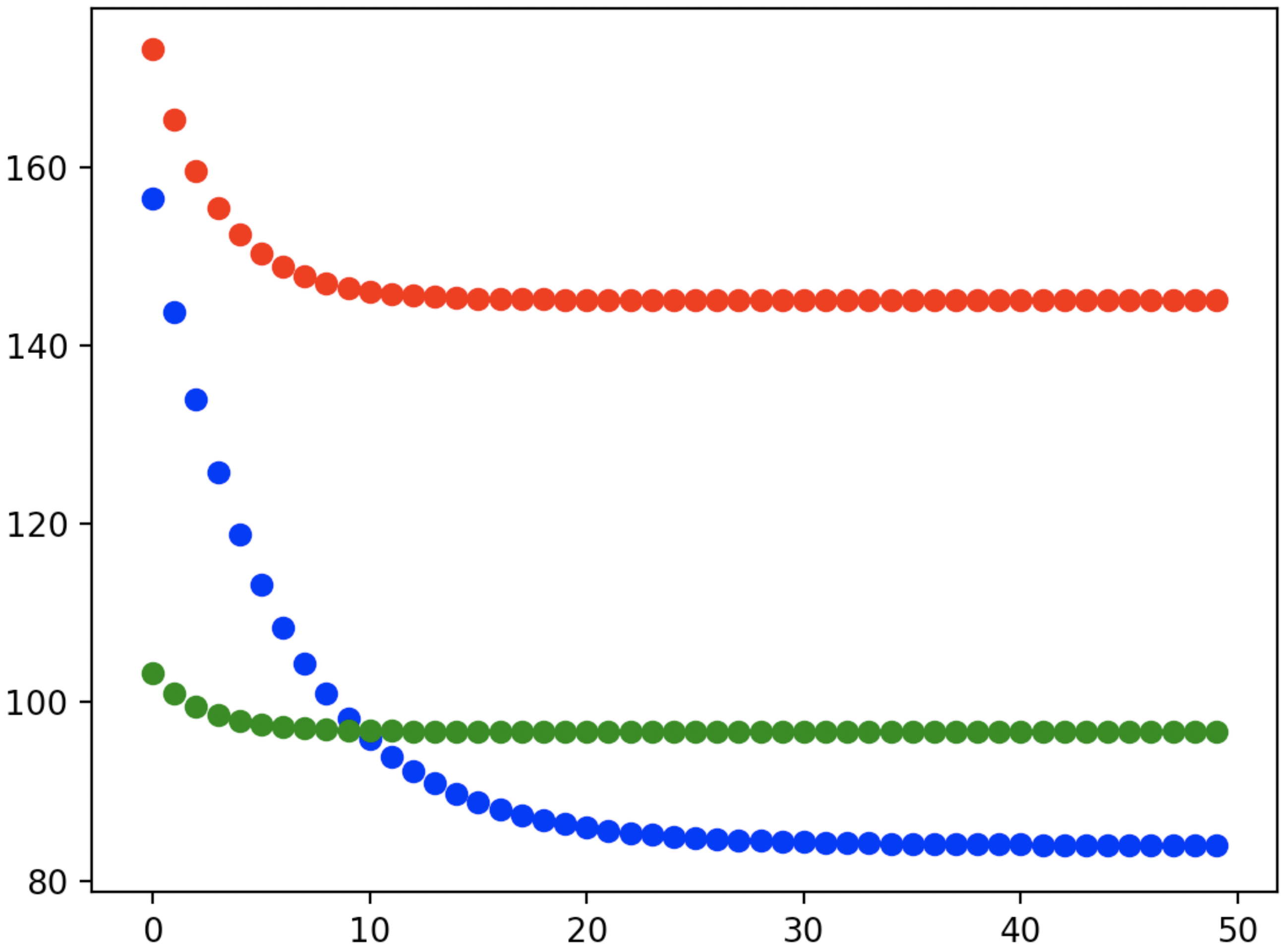
In [11]:
```
#Initializing the paramenters for the number of stores.
#Question_6
init_theta0 = -1
init_theta1 = -0.5
learningRate = 0.01
maxIteration = 50

trained_theta0_ns, trained_theta1_ns = stocashtic_gradient_descent(train_nbrOfStores,train_housevalue,init_theta0,init_theta1,learningRate,maxIteration,'green')
#plt.show()
train_RMSE_ns = findRMSE(train_nbrOfStores, train_housevalue, trained_theta0_ns, trained_theta1_ns)
test_RMSE_ns = findRMSE(test_nbrOfStores, test_housevalue, trained_theta0_ns, trained_theta1_ns)

print('-------------------------*Values obtained on \'Number of convenience stores\' Feature*-------------------------\n')


print(f'Theta_0: {trained_theta0_ns}')
print(f'\nTheta_1: {trained_theta1_ns}')

print('\nRMSE value for training data',train_RMSE_ns)
print('\nRMSE value for testing data',test_RMSE_ns)
```

```
-------------------------*Values obtained on 'Number of convenience stores' Feature*-------------------------

Theta_0: 27.486676129636784

Theta_1: 25.642117651334722

RMSE value for training data 9.83487827563954

RMSE value for testing data 14.731993508206784
```



In [12]:
```
print('Summary:')

print('\n\n--------------------------*Values obtained on House Age Feature*----
----------------------\n')

print(f'Theta_0: {trained_theta0_ha}')
print(f'\nTheta_1: {trained_theta1_ha}')
print('\nRMSE value for training data',train_RMSE_ha)
print('\nRMSE value for testing data',test_RMSE_ha)

print('\n\n-------------------------*Values obtained on \'Distance to the neare
st MRT station Feature\'*-------------------------\n')

print(f'Theta_0: {trained_theta0_ds}')
print(f'\nTheta_1: {trained_theta1_ds}')
print('\nRMSE value for training data',train_RMSE_ds)
print('\nRMSE value for testing data',test_RMSE_ds)

print('\n\n-------------------------*Values obtained on \'Number of convenience
stores\' Feature*-------------------------\n')


print(f'Theta_0: {trained_theta0_ns}')
print(f'\nTheta_1: {trained_theta1_ns}')
print('\nRMSE value for training data',train_RMSE_ns)
print('\nRMSE value for testing data',test_RMSE_ns)
```

```
Summary:


--------------------------*Values obtained on House Age Feature*--------------
------------

Theta_0: 42.54078538346594

Theta_1: -10.319399022339129

RMSE value for training data 12.045510305912353

RMSE value for testing data 16.58731450340051


-------------------------*Values obtained on 'Distance to the nearest MRT stat
ion Feature'*-------------------------

Theta_0: 44.766087037899375

Theta_1: -46.500633970906314

RMSE value for training data 9.165754538401488

RMSE value for testing data 12.652088009723935


-------------------------*Values obtained on 'Number of convenience stores' Fe
ature*-------------------------

Theta_0: 27.486676129636784

Theta_1: 25.642117651334722

RMSE value for training data 9.83487827563954

RMSE value for testing data 14.731993508206784
```


160
140
120
100
80
0
10
20
30
40
50