DSP

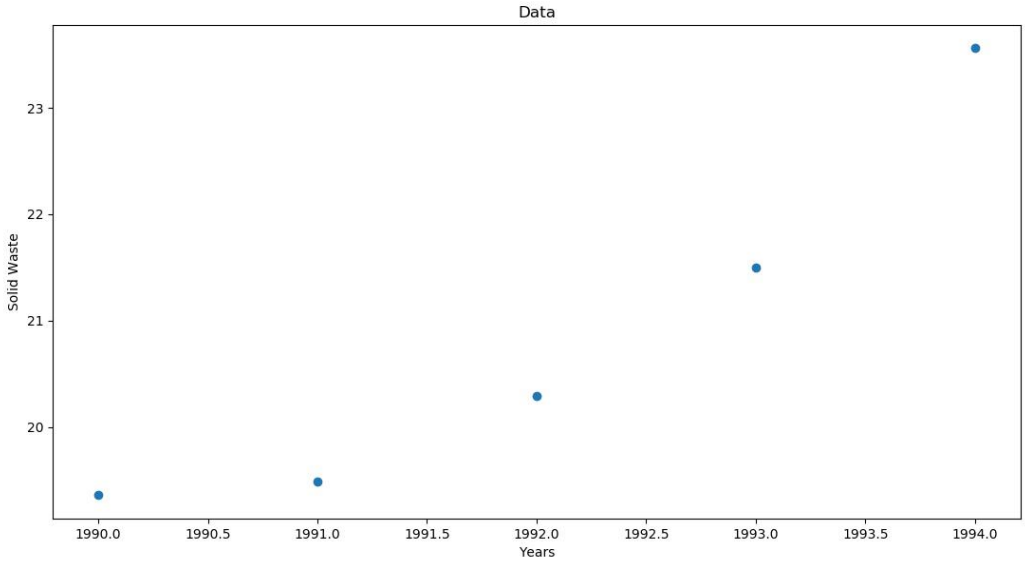
ASSIGNMENT

(1)

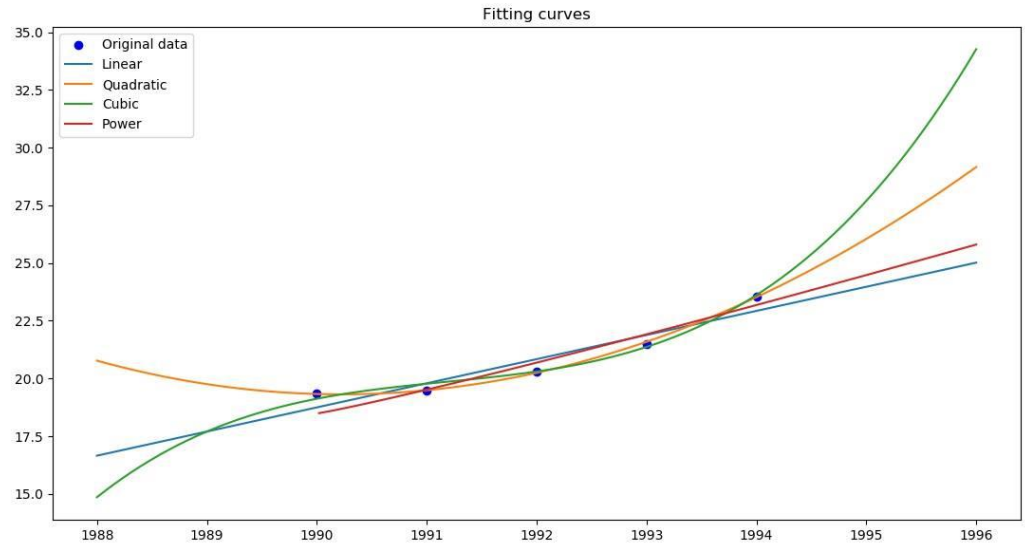
Name	Sec	BN
Bishoy Wael Fouad	1	50
Hussein Naguib Hussein	2	6
Khaled Mohamed El-Ansary	2	7
Sherif Essam Mayhoub	2	22

Question 1:

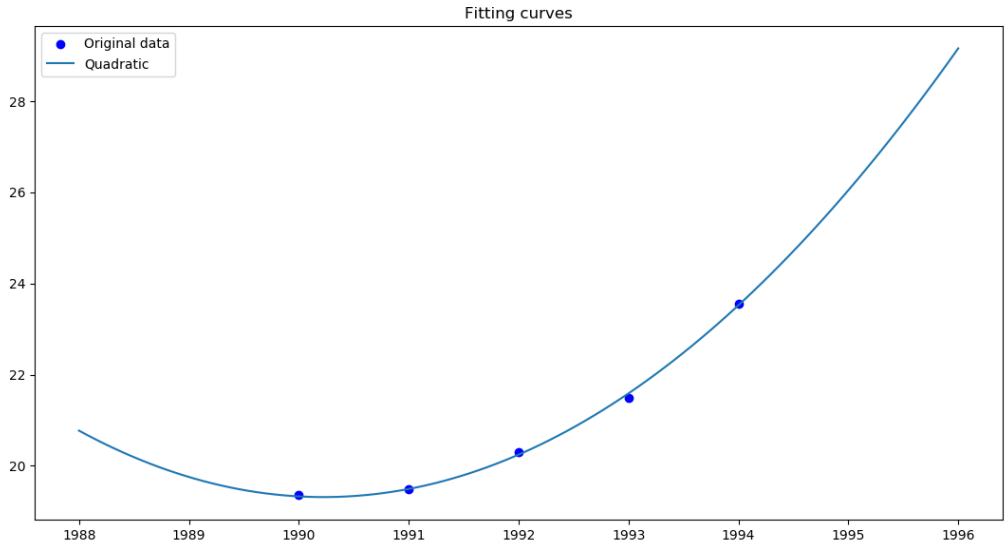
a) In this question we used Tensorflow framework, so as it was required we made a scatterplot of the data, letting x represent the number of years since 1990. And here's the graph:



b) Then it was required to use different functions (linear, quadratic, cubic, and power) to fit the data, so by computing the R^2 to every function we found that the quadratic function has the highest R^2 (0.999). So the quadratic function is the function that best fits the data.



c) Here's a plot for the quadratic function with the scatterplot of the data:

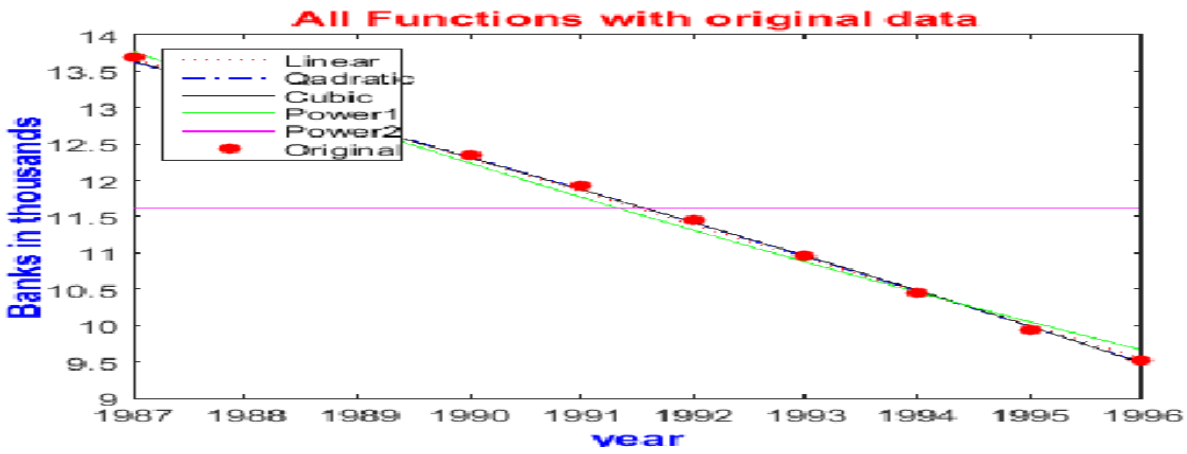


Here's the prediction of the average tons of waste in 2000 and 2005, and we can notice that the quadratic is the most realistic.

```
Optimization Finished!
**********************
Model: Linear R_sqr= 0.892 cost= 0.13128

Model: Linear Parameters:W1= 1.045198 b= 18.745852

Prediction for 2000 is 29.19783 for 2005 34.42382

Optimization Finished!
**********************
Model: Quadratic R_sqr= 0.999 cost= 0.00128

Model: Quadratic Parameters:W1= 0.2950391 W2= -0.13163923
b= 19.327938

Prediction for 2000 is 47.515453 for 2005 83.73715

Optimization Finished!
**********************
Model: Cubic R_sqr= 0.987 cost= 0.01593

Model: Cubic Parameters:W1= 0.108576916 W2= -0.38537267 b=
19.12083

Prediction for 2000 is 98.430984 for 2005 312.76477

Optimization Finished!
**********************
Model: Power R_sqr= 0.898 cost= 0.12359

Model: Power Parameters:W1= 1.0931875 W2= 1.0320269 b=
18.483383

Prediction for 2000 is 31.273617 for 2005 38.40751
```

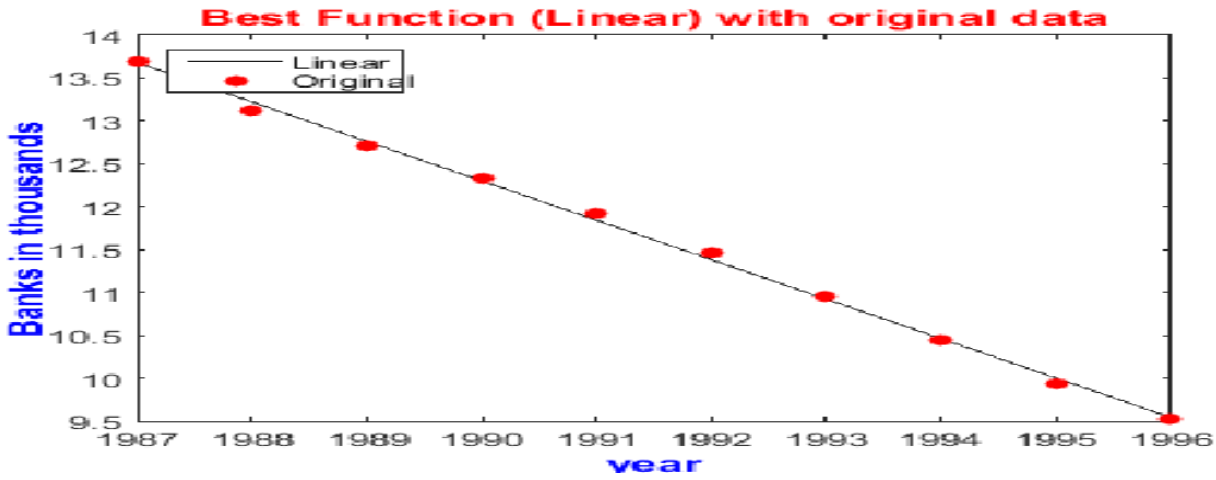
Question 2:

a) Using MATLAB we made a scatterplot of the data, letting x represent the number of years since 1987:



By comparing the values of R^2 it was clear that cubic curve has the best fit with R^2 = 0.9981

b) & e)



It is clear that the fit model has a good representation for the given data.

C) Predicted average numbers of Banks calculated from the regression model as follows:

1) Average numbers of Banks in 2000 is 7.7138 Banks.

2) Average numbers of Banks in 2005 is 5.4202 Banks.

Question 3 :

The given data was fed into a MATLAB code and be prepared for the fitting using these few lines :

```
clc;
Height = [1.03754 , 1.40205 , 1.63806 , 1.77412 , 1.80392 , 1.71522 , 1.50942 ,1.21410
            ,0.83173];
Time = [0 , 0.1080 , 0.2150 , 0.3225 , 0.4300 , 0.5375 , 0.6450 , 0.7525 , 0.8600];

% Prepare the input data for the fitting
y = Height';
x = [ones(length(Time),1) Time'];
```

Then, input and output data were fitted using different functions :

a) Linear fitting :

```
[linear , linear_gof] = fit(x(:,2), y, 'poly1')
```

b) Quadratic fitting :

```
[Quadratic , Quadratic_gof] = fit(x(:,2), y, 'poly2')
```

c) Cubic fitting :

```
[cubic , cubic_gof] = fit(x(:,2), y, 'poly3')
```

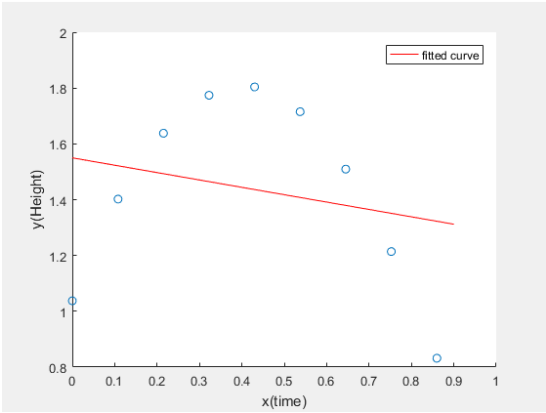
d) Power function

```
% Adjusting the 0 case to allow power function
for i = 1:length(Time)
    if x(i,2)== 0
        x(i,2)= x(i,2)+0.001
    end
end
[power , power_gof] = fit(x(:,2), y, 'power1')
```

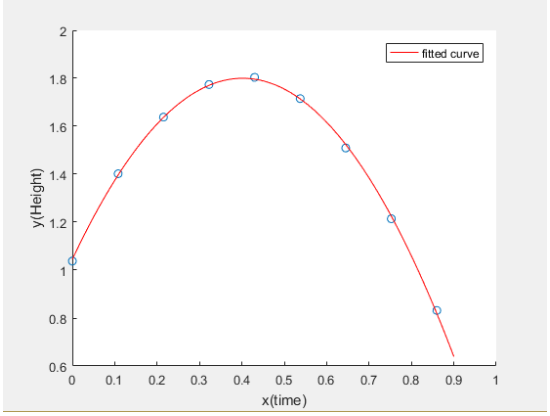
After that, the data was scattered and the fitted curve was draw (for each case) using the following lines:

```
scatter(x(:,2),y);

hold on
plot(Quadratic )
xlabel('x(time)')
ylabel('y(Height)')
```

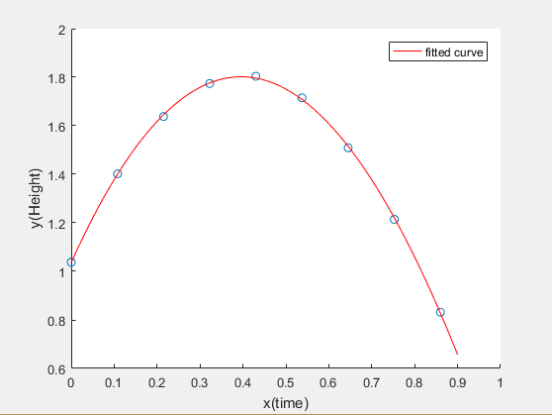
Here are the output graphs:



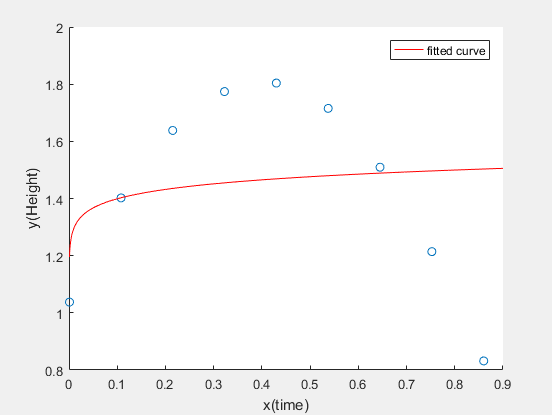
(Linear fitting)



(Quadratic fitting)



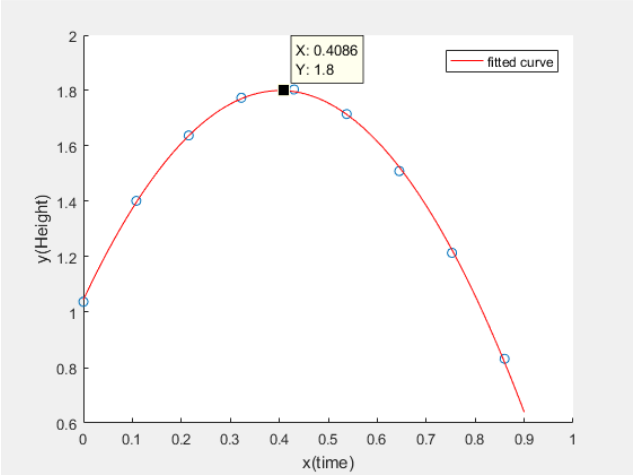
(Cubic fitting)



(Power fitting)

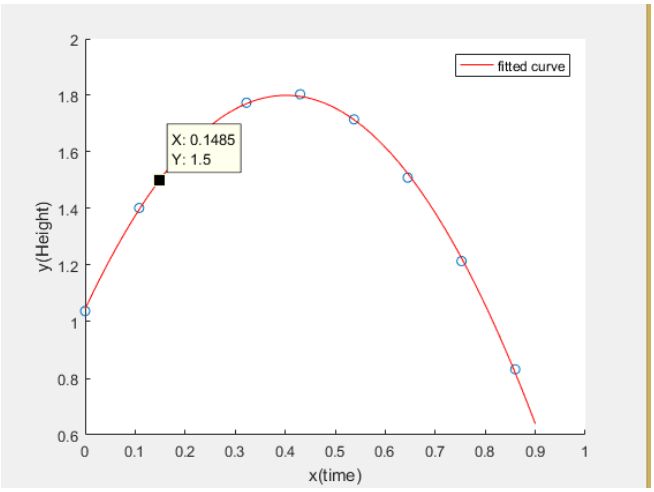
It is clear that, quadratic and cubic functions fitting the scattered data well.

Using the quadratic fitting, the maximum height of the ball = 1.8 meters



maximum height is 1.8 meter at x=0.4086 sec

When the height is at least 1.5 meter:



The height is at least 1.5 after 0.1485 sec

Problem 4:

The given data was fed into a MATLAB code and be prepared for the fitting using these few lines :

```
Population = [3.93  , 5.31  , 7.24 , 9.64 , 12.86 ,17.07 , 23.19 ,31.44];
Year = [1790  , 1800 , 1810 , 1820 , 1830 , 1840 , 1850 , 1860];
Year = Year - 1780;

% Prepare the input data for the fitting
y = Population';
x = [ones(length(Year),1) Year'];
```

Then, input and output data were fitted using different functions :

a) Linear fitting :

```
[linear , linear_gof] = fit(x(:,2), y, 'poly1')
```

b) Quadratic fitting :

```
[Quadratic , Quadratic_gof] = fit(x(:,2), y, 'poly2')
```

c) Exponential fitting :

```
[exponential , exponential_gof] = fit(x(:,2), y, 'exp1')
```

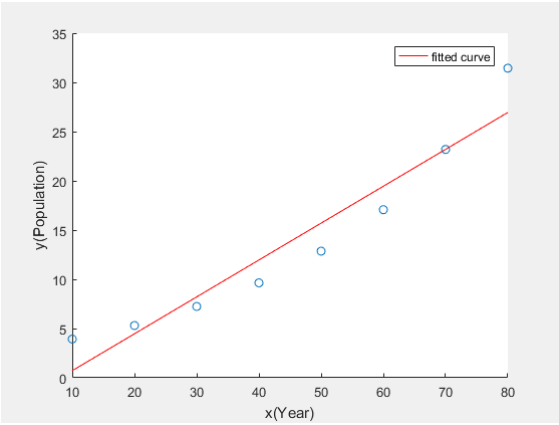
d) Power function :

```
[power , power_gof] = fit(x(:,2), y, 'power1')
```

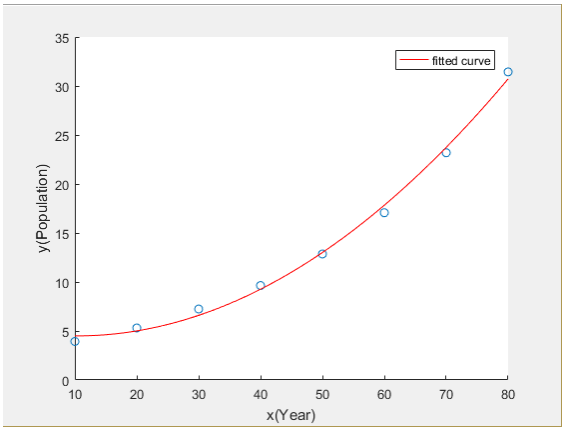
After that, the data was scattered and the fitted curve was draw (for each case) using the following lines:

```
scatter(x(:,2),y);

hold on
plot(exponential)
xlabel('x(time)')
ylabel('y(Height)')
```

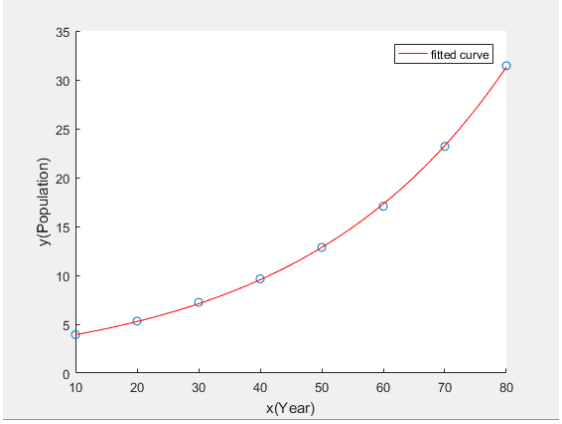
Here are the output graphs:



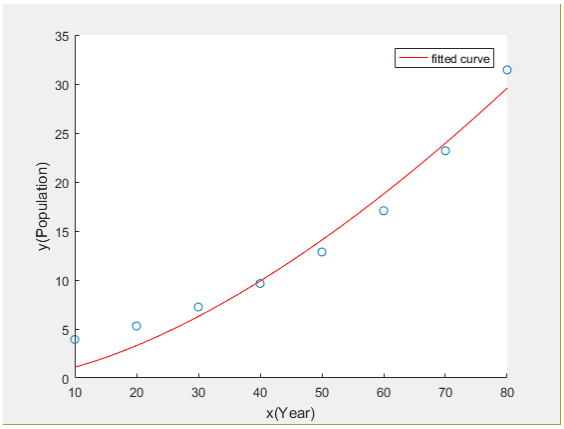
(Linear fitting)



(Quadratic fitting)



(Exponential fitting)



(Power fitting)

It is clear that, the exponential function is fitting the scattered data well.

Using the exponential fitting, the predicted population at 1870 is 42.1425 millions

>> exponential(1870-1780)

ans = 42.1425

At 1930, the expected population is 250.1568 millions

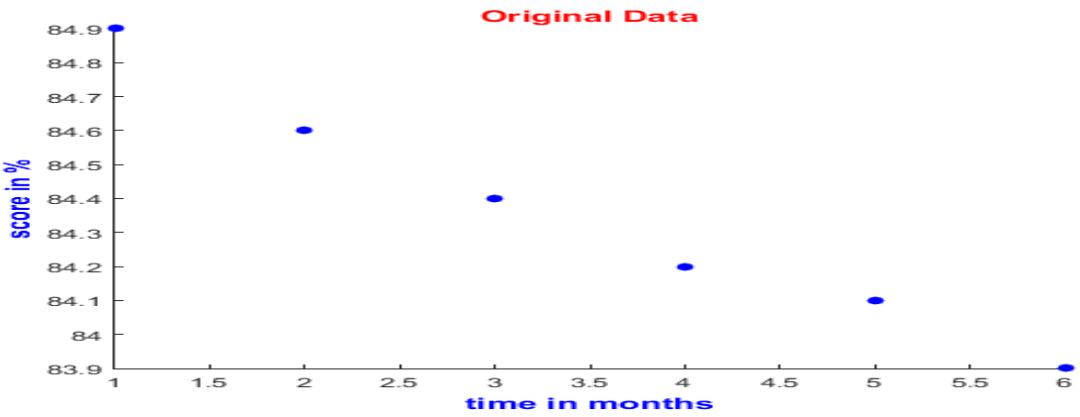
>> exponential(1930-1780)

ans = 250.1568

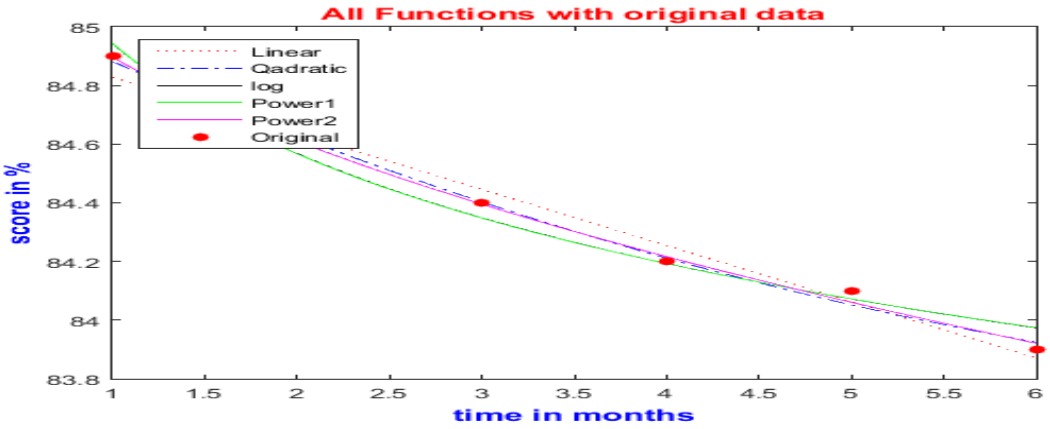
We feel that this prediction does not have validity, as after 90 years from our last input year the model could follow another shape for its equation (not exponential).

Question 5:

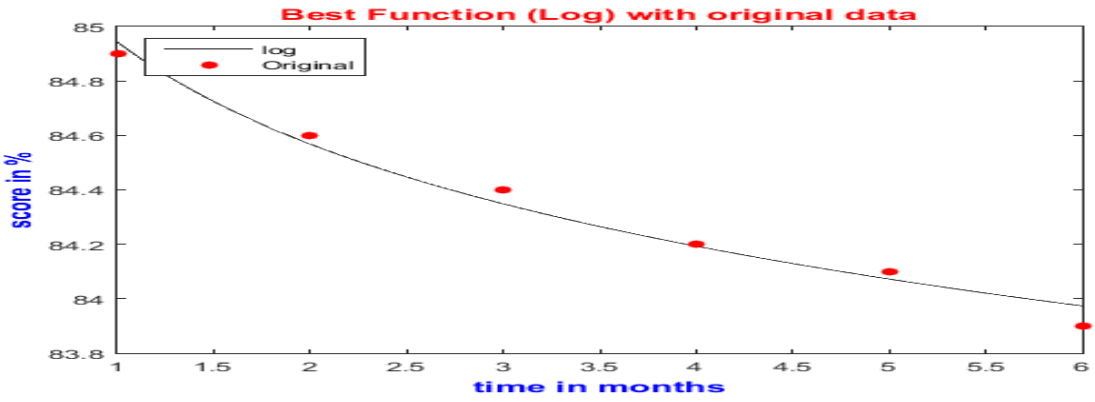
a) Using MATLAB we made a scatterplot, letting x represent the number of seconds elapsed:



b) Then it was required to use different functions (linear, quadratic, logarithmic, and power) to fit the data:



c) By comparing the values of R^2 it was clear that cubic curve has the best fit with R^2 = 0.9979



d) Predicted scores were calculated from the regression model as follows:

Score after 8 months = 83.818%

Score after 10 months = 83.6972%

Score after 24 months = 83.2233%

Score after 36 months = 83.0038%

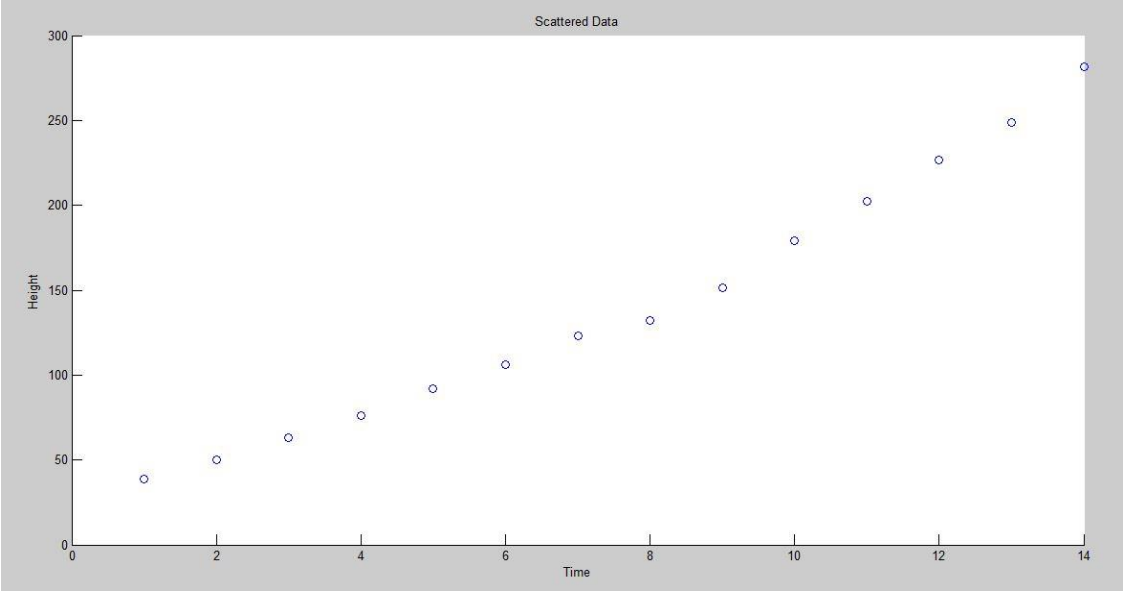
e) From the regression model it was calculated that:

Score after 230 months = 82%

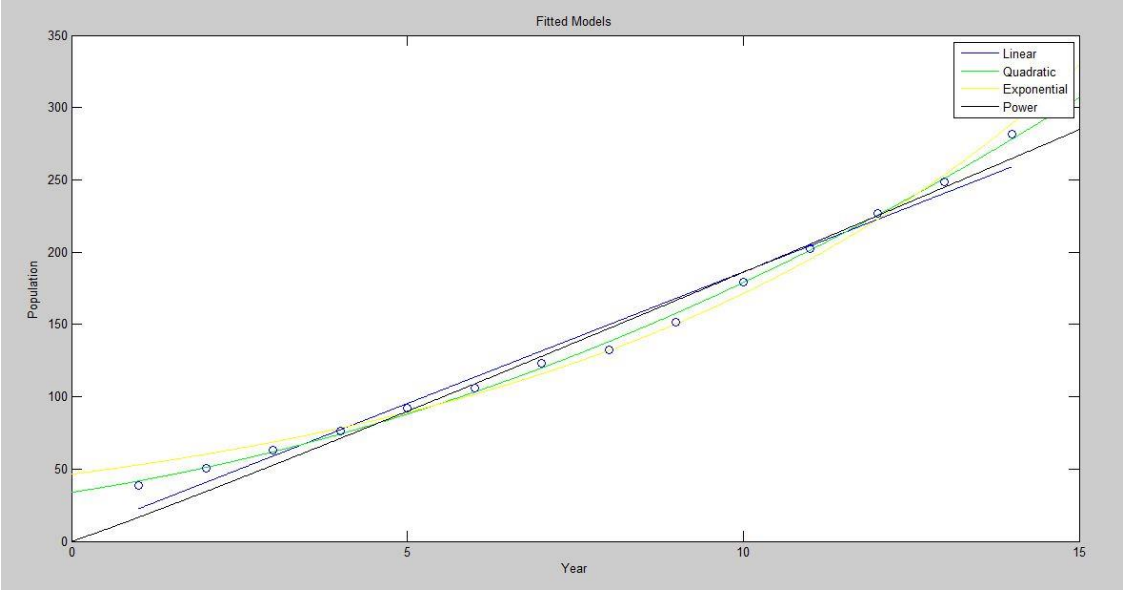
Therefore the test scores falls below 82% after 230 months.

Question 6:

a) Using MATLAB we draw a scatter plot of the data:



b) Then it was required to use different functions (linear, quadratic, exponential and power) to fit the data, and we found that the quadratic is the function that best fits the data with R^2 equal 0.9981:



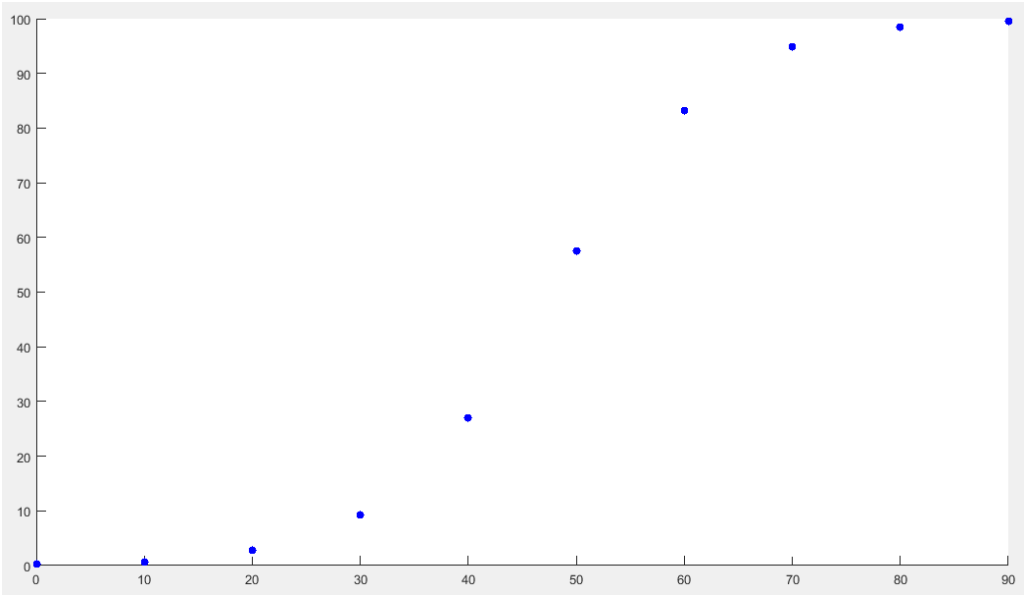
c) Using the regression model to predict the population in 1975 and in 2010:

The population in 1975 = 213.3707

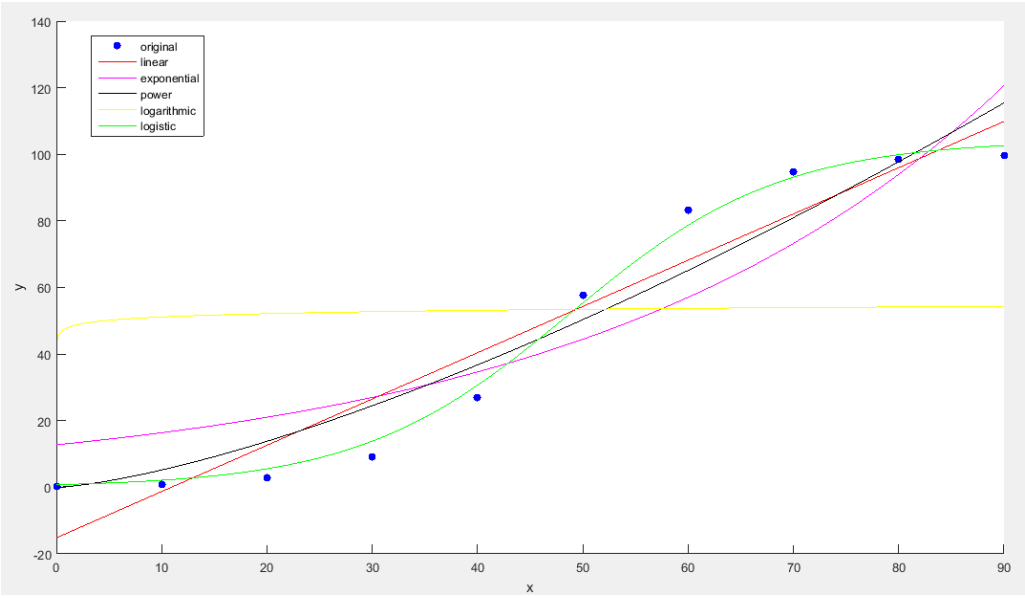
The population in 1975 = 306.6684

Question 7:

a) Using MATLAB draw a scatter plot of the data:



b) Then it was required to use different functions (linear, exponential, power and logarithmic) to fit the data, and we found that the quadratic is the function that best fits the data with R^2 equal 0.9981:

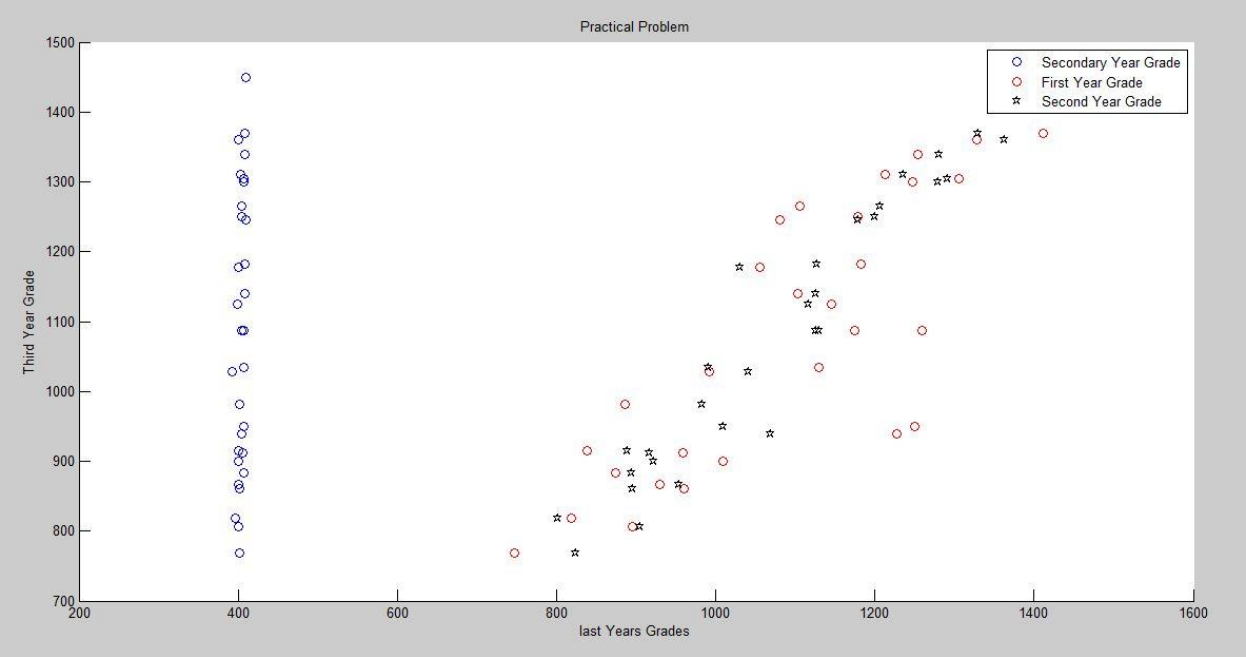


By comparing the R^2 of the different graphs we can observe that the function with highest R^2 is the logistic function (0.995), so the logistic is the function that best fits the data.

c) Using the regression model to predict the percent P of people who will buy the software after 100 ads are run, we got a percentage of 103.7%.

Question 8:

a) Using MATLAB we draw a scatter plot of the training data:



b) Then it was required to use different functions (linear, quadratic, polynomial of higher order, exponential, power, logarithmic, and logistic) to fit the data, and we found that the cubic is the function that best fits the data with R^2 equal 0.9809.

c) Standard deviation is 13.2070 points which corresponds to a very small percentage of deviation from the mean which corresponds to efficiency of the model

d) We found that outliners are 2 point where grade of first year is above 1200 and third year grade lower than 1000.