DA ASSIGNMENT – 02

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Data Pre-processing:

- Firstly I had taken all the rows of data whose columns having the values *"Error.In.Data = 0"*, *"Wickets.in.Hand != 0"*, *"Innings = 1"*.
- After pre-processing, the number of rows in data remaining are **66951**.

Approach:

- **Question 01:**
  - First I made the function to calculate the value Z(u, w) using the formula given in the question.
  - For Initializing the value of Z0, first I have taken the average value of *"Runs.Remaining"* column for a particular team and for a specific no. of wickets in hand. Then I had taken the average of all the values of (*"Runs.Remaining"*) teams for specific no. of wickets in hand.
  - For Initializing the value of b, I have taken the value 0.04 for all 10 wickets.
  - Then I have used the sum of squared errors loss function, summed across overs and wickets.
  - Then to optimize the parameters i.e. Z0 and b (20 parameters), I have used the **minimize()** function of scipy.optimize library.

  The Initial values of Z0 and b which I had taken are:

  Z0: [4.85502748825418, 12.85401732538484, 23.575411062304727, 37.668628937055026, 56.928588078718214, 83.12674911114453, 115.41158862745114, 150.28562187822308, 186.3207681520998, 222.81021162450966]

  b: [0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04]

- **Question 02:**
  - For implementing second question function, I have used the similar approach.
  - I have only replaced the b with the L parameter.
  - Then to optimize the parameters i.e., Z0 and L (11 parameters), I have used same minimize() function scipy.optimize library.

The Initial values of Z0 and L which I had taken are:

Z0: Similar as what I had taken in 1st Question function.

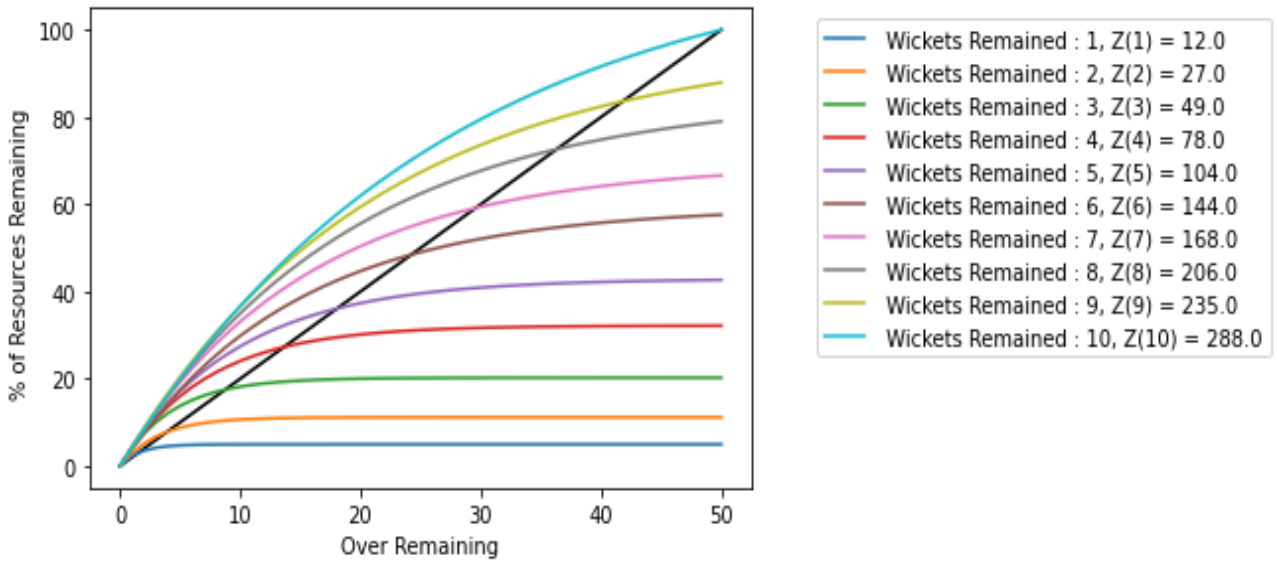
L: 3

Question 01:

- **Table for Z0(w) and b(w) for each w:**

Wickets in Hand	1	2	3	4	5	6	7	8	9	10
Z0(W)	12	27	49	78	104	144	168	206	235	288
B	0.6164	0.3091	0.2292	0.1377	0.1020	0.0697	0.0649	0.0530	0.0474	0.0368

- **Graph Plot:**



- **Error Per Point:**
  - 1559.76702223287

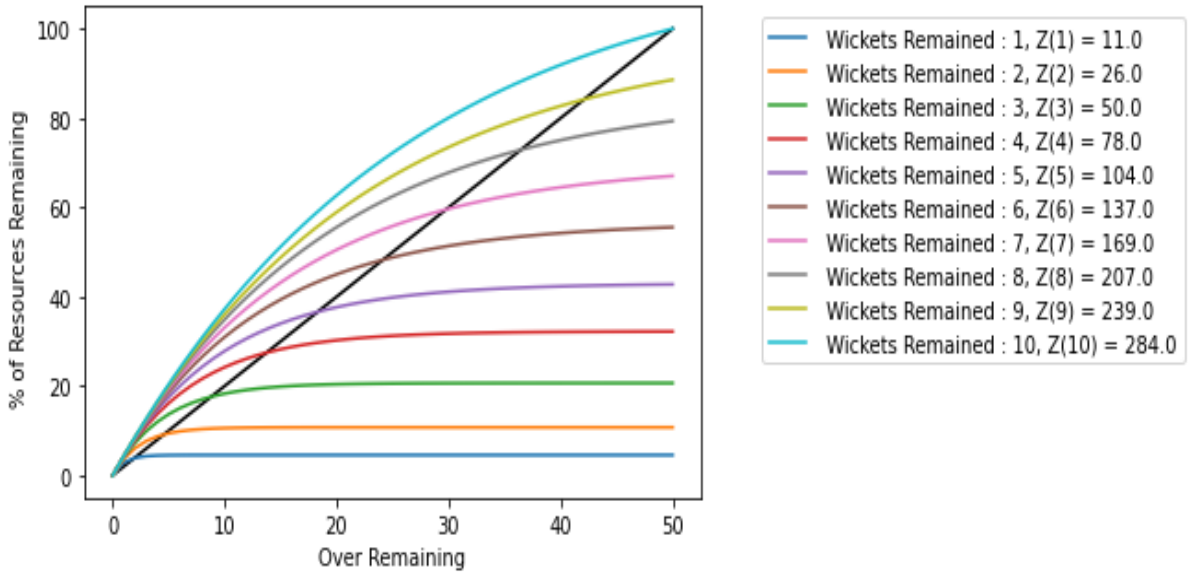
Question 02:

- **Table for Z0(w) and L for each w:**

Wickets in Hand	1	2	3	4	5	6	7	8	9	10
Z0(W)	11	26	50	78	104	137	169	207	239	284

  - **L: 10.848691**

- **Graph Plot:**



- **Error Per Point:**
  - 1559.3008946

Question 03:

- Problem 1:
  - To find the slope in problem 1 at u = 0, we differentiate the equation i.e. $Z(u, w) = Z_0(w)[1 – exp\{-b(w)u\}]$ w.r.t u and we get the result as :
    Slope1 = $Z_0(w)$*b(w)

- Problem 2:
  - To find the slope in problem 2 at u = 0, we differentiate the equation i.e. $Z(u, w) = Z_0(w)[1 – exp\{-Lu/Z_0(w)\}]$ w.r.t u and we get the result as :
    Slope2 = L

    - To know how close they are to each other we will find the difference between the slope of both the problems.
    - The Result I got are:

      Difference = Slope1 – Slope2

Wickets in Hand	1	2	3	4	5	6	7	8	9	10
Difference	**-3.45**	**-2.50**	**0.3808**	**-0.11**	**-0.24**	**-0.81**	**0.05**	**0.068**	**0.289**	**-0.25**