STA-243 Homework 2

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Answer 1 The code for the solution is provided. Also, 4 different cases were considered.

Case 1) p = 0.999 and Initial Temperature = 400

Case 2) p = 0.9 and Initial Temperature = 400

Case 3) p = 0.999 and Initial Temperature = 800

Case 4) p = 0.9 and Initial Temperature = 800

It was observed that the distance in cases 2 and 4 converged pretty early (iteration < 100) with distance (20) quite close to the true distance. Case 3 (distance = 18) took around 1200 more iterations to converge as compared to Case 1 (distance = 17). The graphs for cost (distance) vs iterations for each of the 4 cases in attatched.

Answer 2 The function outputs the plot of points and estimated y values after every iteration that helps visualising the optimization. The function also outputs the best chromosome (or best breakpoints) and minimum cost after every iteration. The plot for cost vs iterations is provided for both MDL as well as akaike criterias.

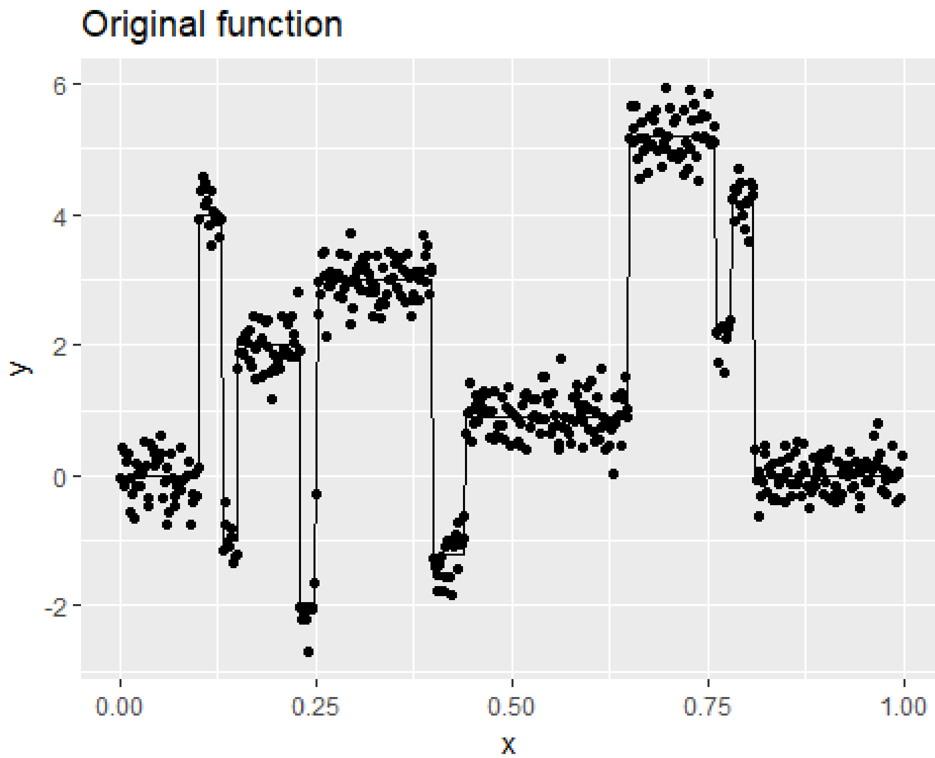
Genetic Algorithm proved to be very successful in mimicking the real function with fewer generations. In the implementation, two changes are considered: i) Step-elitist step is implemented ii) N_same is increased to 30 The most important element according to the study is to involve the step-elitist step, to transfer the best chromosome to the next generation. This helped in achieving a non-decreasing cost after every generation, that resulted in approaching to the optima at a faster rate. Initially, without involving the step-elitist step, the cost after some generations tend to diverge, prolonging the process of optimization. This must be due to production of inferior child chromosome as compared to the parent chromosome due to crossover and mutation. Inreasing the value of N_same is to facilitate genetic algorithm to search the space more exhaustively.

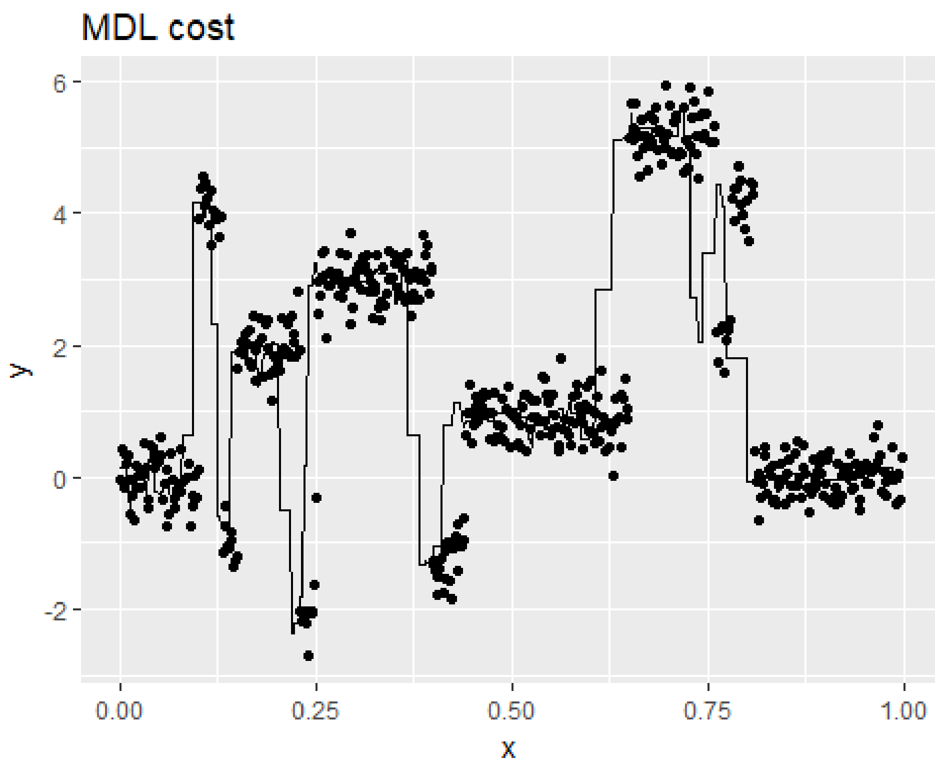
Comparison for MDL and Akaike cost has also been made. The mean square error for these criterias is as following:

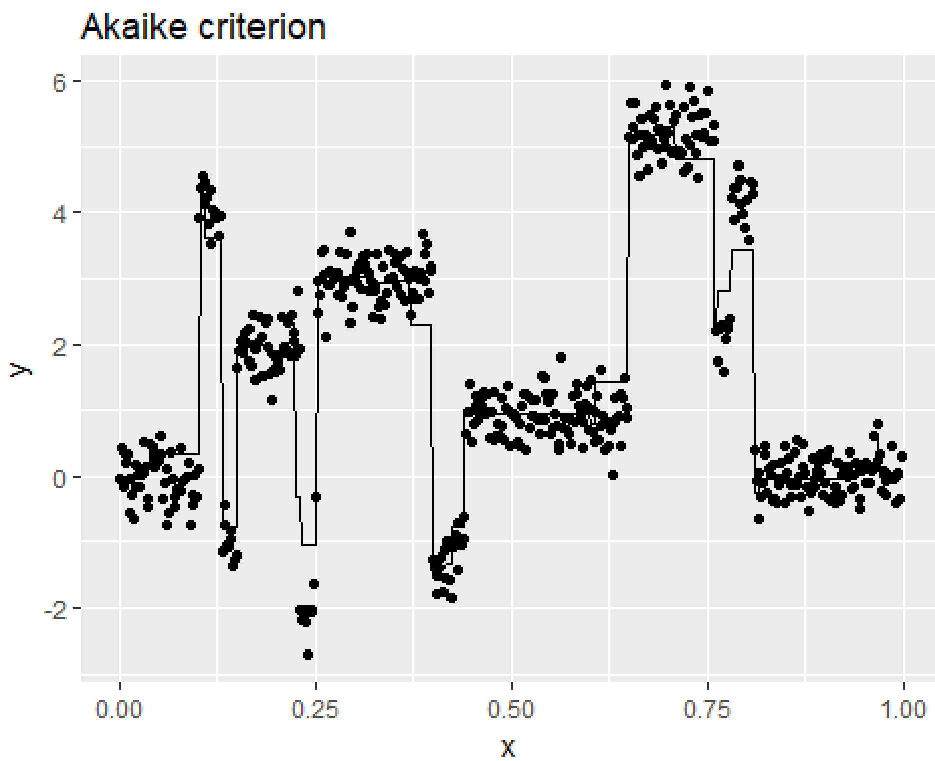
```
## [1] "Mean square error for MDL:  2.70934941888082"

## [1] "Mean square error for Akaike cost:  0.284441248560392"
```

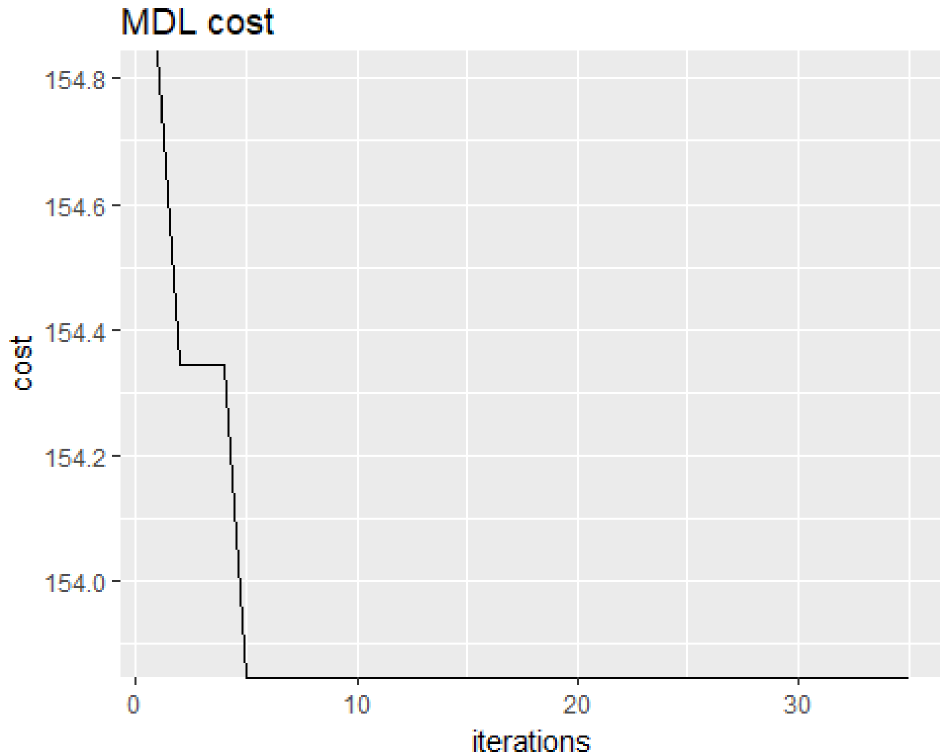
Using MDL cost function takes fewer iterations (33) to converge than Akaike criterion (96), but as seen above, Akaike criterion gives better results. Hence, it is a trade off between computational power and accuracy. The function plots for both the cost functions are:

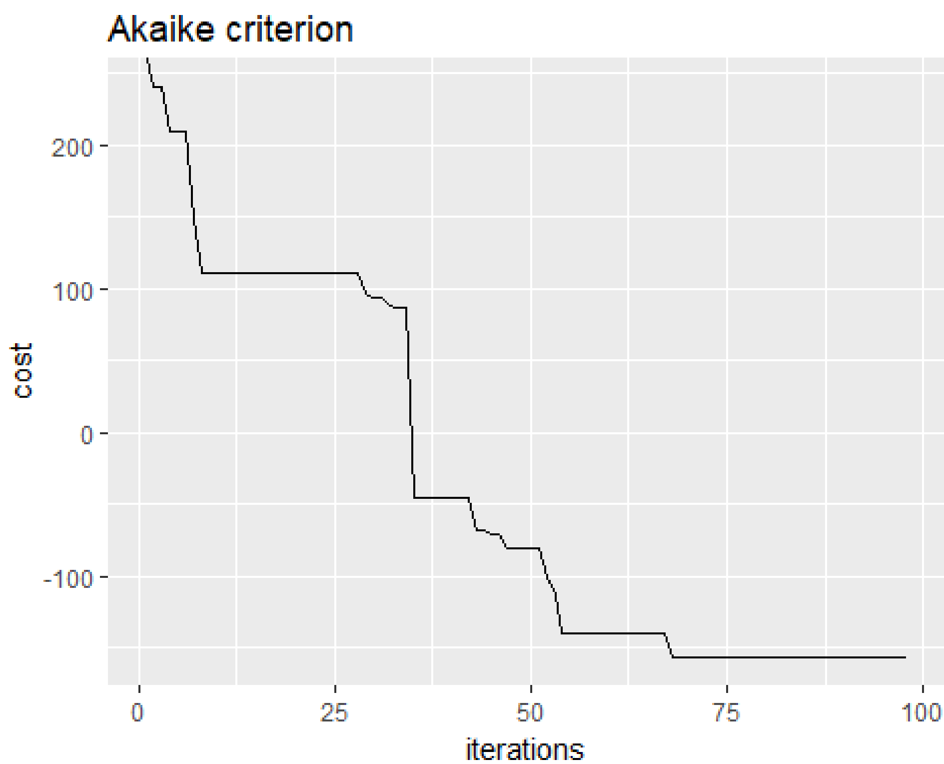



MDL cost
y
6
4
2
0
-2
0.00
0.25
0.50
0.75
1.00
x


Akaike criterion
y
6
4
2
0
-2
0.00
0.25
0.50
0.75
1.00
x

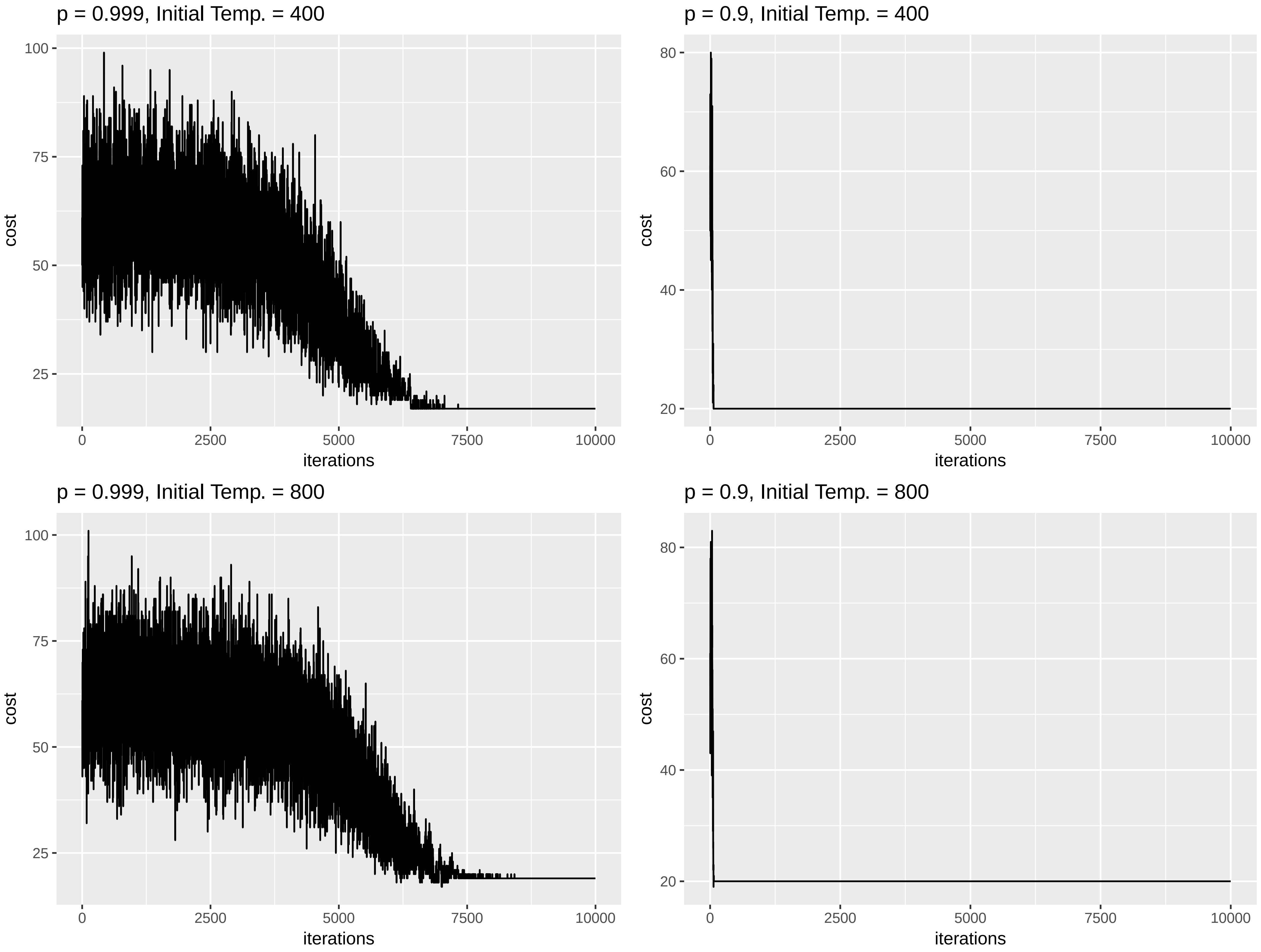
The convergence plots of cost vs iterations are:





The flat line in the MDL cost vs ite graph represents -Infinity.

Ans 1)



p = 0.999, Initial Temp. = 400
p = 0.9, Initial Temp. = 400
p = 0.999, Initial Temp. = 800
p = 0.9, Initial Temp. = 800
cost
iterations
0
2500
5000
7500
10000
25
50
75
100
20
40
60
80