Solution Document

Question 1

I) Filename –Q1_Insertion.py

Method to run file-

>>python Q1_Insertion.py

E.g.

Enter the max size 5

The unsorted list [3, 2, 2, 1, 5]

Sorted list [1, 2, 2, 3, 5]

Time 1.839226771955983e-05

II) Filename –Q1_Quicksort.py

Method to run file-

>>python Q1_Quicksort.py

E.g.

Enter the max size 5

The unsorted list [-4, 0, 3, -5, -3]

Sorted list [-5, -4, -3, 0, 3]

Time 2.138635781344167e-05

III) Filename – Q1_RandomQS.py

Method to run file-python RandomQS.py

E.g.

Enter the max size 5

The unsorted list [-3, -2, -4, -5, 2]

Sorted list [-5, -4, -3, -2, 2]

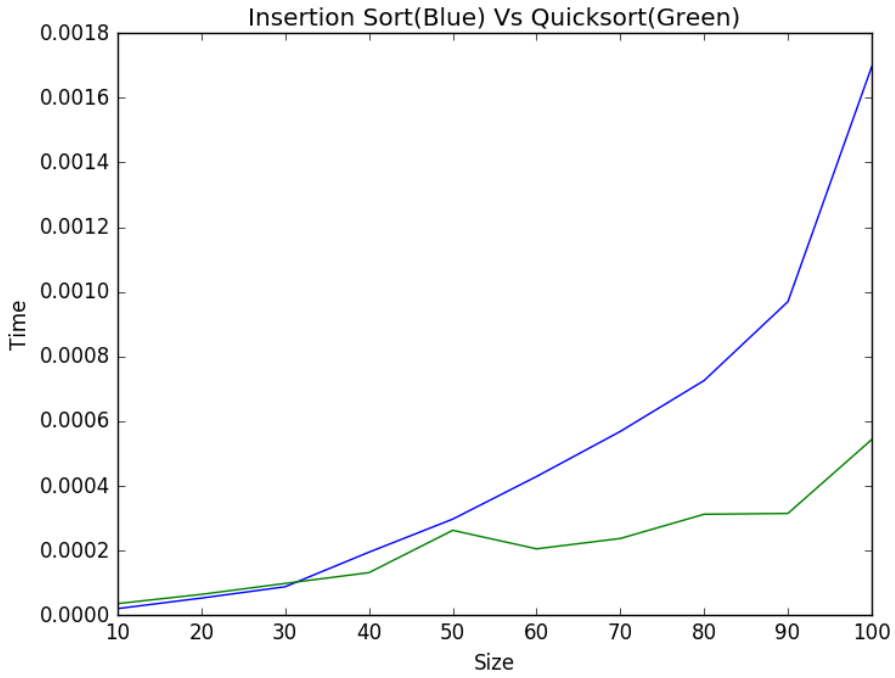
Time 3.8495444064195e-05

Q1 (A)

Soln.

Run the file Q1_ISvsQS.py from command prompt to generate the Time vs Size graph for Insertion vs QuickSort by following the step below:

>>python Q1_ISvsQS.py



Size	InsertionSort(Time)	QuickSort(Time)
10	2.05E-05	3.59E-05
20	5.30E-05	6.46E-05
30	8.81E-05	9.84E-05
40	0.000195044	1.32E-04
50	0.00029727	0.000262624
60	0.00042901	2.05E-04
70	0.000568449	2.37E-04
80	0.000725853	3.12E-04
90	0.000969657	3.15E-04
100	0.001695938	5.43E-04

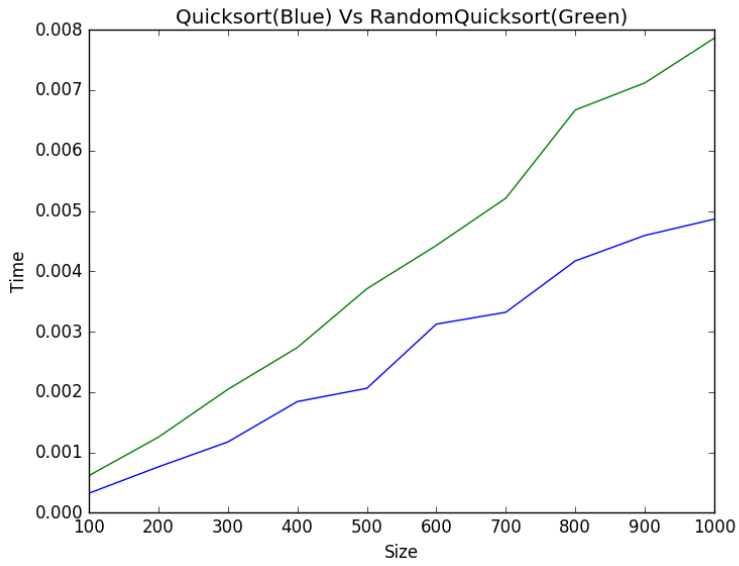
Q1_A_Graph.png represents the graph for running time of Insertion and Quick sort. We can observe from the graphs that at the input size of around 30 the Insertion Sort overtakes Quick Sort in terms of time. From this we can conclude that Quick Sort becomes more efficient than Insertion Sort as Size increases.

Q1 (B)

Soln.

Run the file Q1_QSvsRQS.py from command prompt to generate the Time vs Size graph for QuickSort vs RandomQuickSort by following the step below:

>>python Q1_QSvsRQS.py



Size	QuickSort(Time)	RandomQuickSort(Time)
100	0.000321223	0.000613361
200	0.000758788	0.001250674
300	0.001171545	0.002042397
400	0.00184051	0.002736171
500	0.002060362	0.003708822
600	0.003124119	0.004427832
700	0.003320446	0.005211
800	0.004171623	0.006672544
900	0.004592934	0.007120374
1000	0.004863685493932901	0.007862908

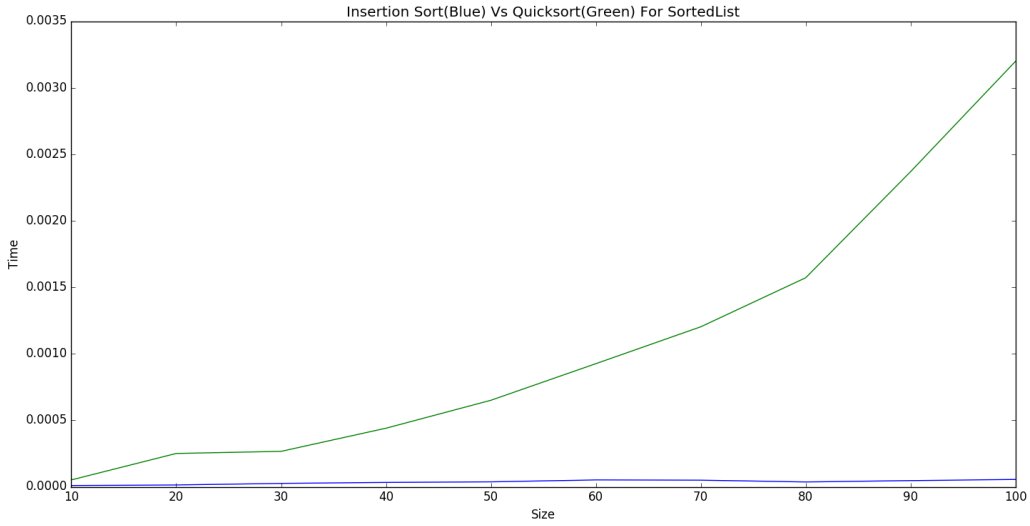
Q1_B_Graph.png represents the graph for running time of Quick sort and Randomize Quick sort. We can interpret from the graphs that running time of both the algorithms show somewhat similar behavior with Quick sort having less running time as compared to RandomQuicksort with increase in Size due to overhead of calculating Random Pivot in RandomQuickSort . Therefore both of the algorithms seem to be feasible for a random list as input though Quicksort seems efficient over Random Sort.

Q1 (C)

Soln.

Run the file Q1_QSvsRQS.py from command prompt to generate the Time vs Size graph for QuickSort vs RandomQuickSort by following the step below:

>>python Q1_QSvsISforSortedList.py



Size	InsertionSort(Time)	QuickSort(Time)
10	9.84E-06	5.18E-05
20	1.37E-05	0.000250648
30	2.57E-05	0.000266474
40	3.29E-05	0.000440559
50	3.72E-05	0.000650573
60	5.18E-05	0.000925602
70	5.00E-05	0.001202769
80	3.64E-05	0.00157147
90	4.66E-05	0.002369181
100	5.52E-05	0.003198544

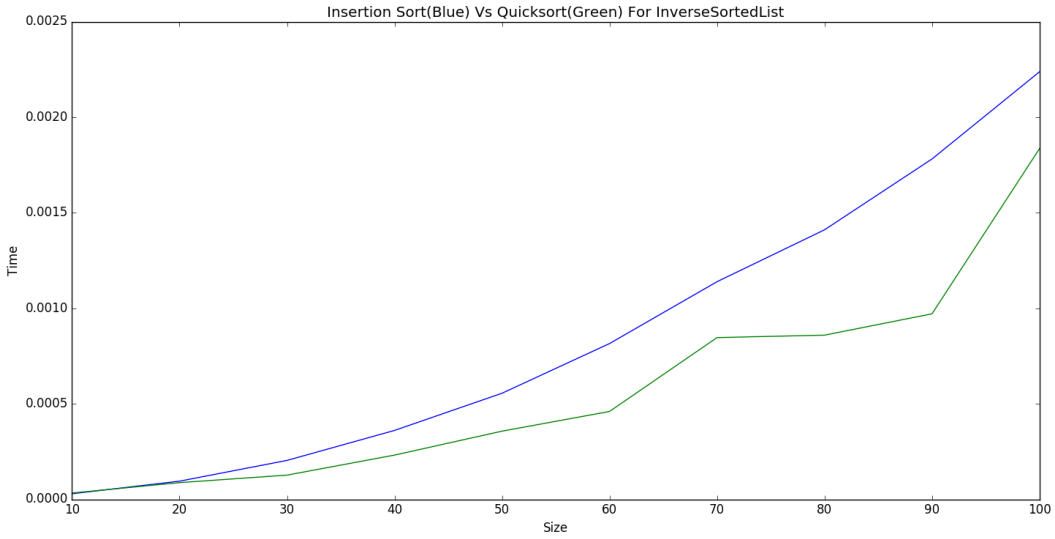
Q1_C_Graph.png represents the graph for running time of Insertion and Quick sort for a sorted input list. We can see from the graphs that the two graphs are deviating from each other with running time of Quick Sort increasing exponentially with increase in input size whereas Insertion sort shows somewhat similar running times with increase in input size for a sorted list. Thus we can conclude that Insertion Sort is better than Quick Sort for an already sorted list.

Q1 (D)

Soln.

Run the file Q1_ISvsQS_ReverseSort.py from command prompt to generate the Time vs Size graph for QuickSort vs RandomQuickSort by following the step below:

>>python Q1__ISvsQS_ReverseSort.py



Size	InsertionSort(Time)	QuickSort(Time)
10	2.91E-05	3.29E-05
20	9.50E-05	8.73E-05
30	0.000203598	0.000126607
40	0.000360574	0.0002314
50	0.00055519	0.000356724
60	0.000815248	0.000459807
70	0.001139037	0.000846472
80	0.001410644	0.000859304
90	0.001781484	0.000970941
100	0.002237868	0.001835805

Q1_D_Graph.png represents the graph for running time of Insertion and Quick sort for an inversely Sorted list. We can observe from the graph that the Insertion Sort overtakes Quick Sort in terms of running time with increase in input size for an inversely sorted list. Thus we can conclude that Quick Sort works more efficiently than Insertion Sort for an Inversely sorted list with increase in input size.

Question 2

Filename –Greedy.py

Method to run file-

>>python Greedy.py

e.g. enter number of categories:5

2

2

1

1

1

[2, 2, 1, 1, 1]

The GQ is : 2

Expected output – Maximum Greed Quotient