

```

3 void Interchange(vector<int>& a, int i, int j)
4 {
5     int p = a[i];
6     a[i] = a[j];
7     a[j] = p;
8 }
9
10 int Partition(vector<int>& a, int m, int p)
11 {
12     int v = a[m];
13     int i = m;
14     int j = p;
15     while(i <= j) {
16         while(a[i] <= v)
17             i++;
18         while(a[j] > v)
19             j--;
20         if(i < j)
21             Interchange(a, i, j);
22     }
23     a[m] = a[j];
24     a[j] = v;
25     return j;
26 }
27 vector<int> a;
28 void RQuickSort(int p, int q)
29 {
30     if(p < q) {
31         if((q - p) > 5)
32             Interchange(a, rand() % (q - p + 1) + p, p);
33         int j = Partition(a, p, q);
34         RQuickSort(p, j - 1);
35         RQuickSort(j + 1, q);
36     }
37 }
38 vector<int> b;

```

```

39 void QuickSort(int p, int q)
40 {
41     if(p < q) {
42         int j = Partition(b, p, q);
43         QuickSort(p, j - 1);
44         QuickSort(j + 1, q);
45     }
46 }
47
48 int main()
49 {
50     int n = 15000;
51     srand(time(0));
52     for(int i = 0; i < n; i++)
53         a.push_back(rand() % 200 + 1);
54
55     for(int i = 0; i < a.size(); i++)
56     {
57         b.push_back(a[i]);
58     }
59
60     cout << "Total Data: " << n << endl;
61     auto Start = chrono::high_resolution_clock::now();
62     //RQuickSort(0, a.size() - 1);
63     QuickSort(0, b.size() - 1);
64     auto End = chrono::high_resolution_clock::now();
65     chrono::duration<double, std::milli> duration = End - Start;
66     cout << "Total Time for QuickSort: " << duration.count() << " millisecond" << endl;
67
68     auto Startr = chrono::high_resolution_clock::now();
69     RQuickSort(0, a.size() - 1);
70     //QuickSort(0, a.size() - 1);
71     auto Endr = chrono::high_resolution_clock::now();
72     chrono::duration<double, std::milli> durationr = Endr - Startr;
73     cout << "Total Time for RQuickSort: " << durationr.count() << " millisecond" << endl;
74

```

"D:\Education\DUET\3rd year 1st semester\Sessional\Algori...

Total Data: 15000

Total Time for QuickSort: 13.3643 millisecond

Total Time for RQuickSort: 0.9976 millisecond

Process returned 0 (0x0) execution time : 0.0095 s  
Press any key to continue.

