DAA Lab-8

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Q-8.1) Write a program to implement the activity selection problem stated as follows.
You are given n activities with their start and finish times. Select the maximum number of activities that can be performed by a single person, assuming that a person can only work on a single activity at a time. For n = {10, 50, 100}, generate start time s[i] randomly in the range [1-50], [1-100], and [1-150], respectively. Then, the finish time is f[i] = s[i] + x[i], where x[i] is a random number generated in the range [1,s[i]].
Report maximum number of compatible activities and run time.

Program:

```
/*
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Idea of the solution:
        I have taken a activity structure which keeps id, start and end of the activity. And using quick sort algorithm I have sorted the activity structure array on the basis of the end time of the activity. And then by recursive and iterative approaches I have found the maximum no of activities that can be taken and analysed the time for both the algorithms and then displayed it.
*/

#include<bits/stdc++.h>
#include<stdio.h>
#include<stdlib.h>
#include<time.h>

using namespace std;

int n=10,a[10],f=0;                                     //size and global flag.

struct activity                                         //activity structure
{
   int id,start,end;
}s[10],t;

int partition(int p,int r)                              //for quick sort
   {
      int j,i=p-1;
      int pivot=s[r].end;

      for(j=p;j<=r-1;j++)
         {
            if(s[j].end<=pivot)
```
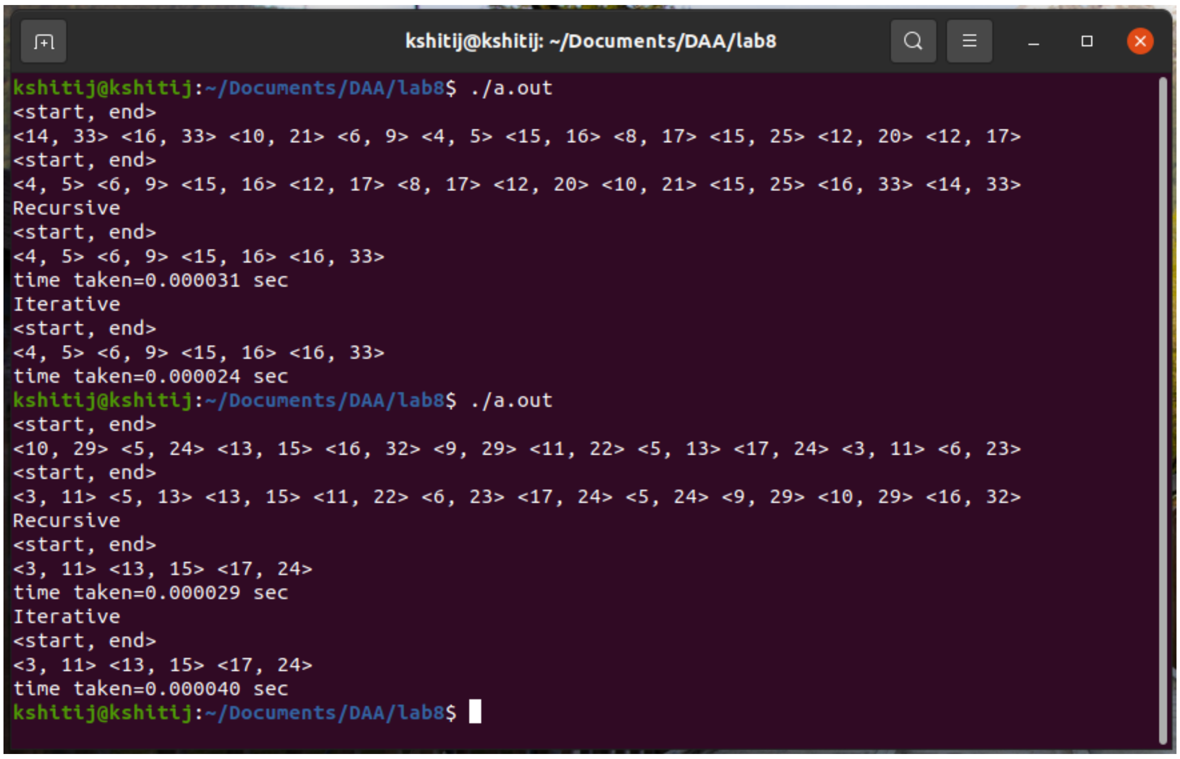
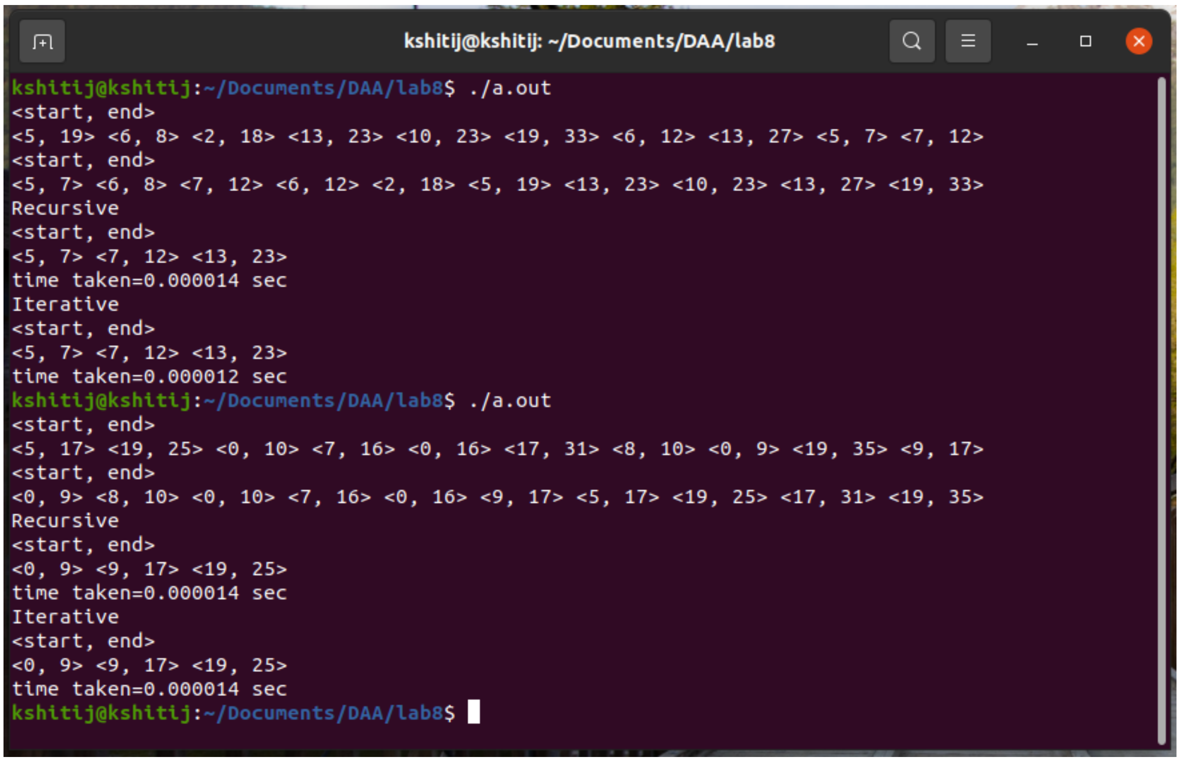

```
                {
                    i++;
                    t=s[i];
                    s[i]=s[j];
                    s[j]=t;
                }
        }
        t=s[i+1];
        s[i+1]=s[r];
        s[r]=t;
        return i+1;
    }
int random_partition(int p,int r)                        //for quick sort
    {
      srand(time(0));
      int i=(rand()%(r-p+1))+p;
      t=s[r];
      s[r]=s[i];
      s[i]=t;
      return partition(p,r);
    }
void random_quick_sort(int p,int r)                      //for quick sort
    {
      int q;
      if(p<r)
        {
          q=random_partition(p,r);
          random_quick_sort(p,q-1);
          random_quick_sort(q+1,r);
        }
    }
int pos(int a)                                           //this returns the position of activity id
    {
      int i;
      for(i=0;i<n;i++)
        {
        if(a==s[i].id)
          return i;
        }
    }
void print()                                                   //to display activities
    {
      int i;
      cout<<"<start, end> \n";
      for(i=0;i<n;i++)
        {
          cout<<"<"<<s[i].start<<", "<<s[i].end<<">"<<" ";
        }
      cout<<endl;
  }
void print(int c[],int n)
  {
      int i;
      cout<<"<start, end> \n";
      for(i=0;i<n;i++)
        {
          cout<<"<"<<s[pos(c[i])].start<<", "<<s[pos(c[i])].end<<">"<<" ";
        }
      cout<<endl;
  }
void activity_selector_recursive(int k)                         //activity selection recursive
  {
      int m=k+1;                                                 //next activity to be checked
      if(k==0)                                                   //keeping first activity
        {
          a[f]=s[k].id;                                          //keeping selected activity in a[]
          f++;
        }
      while(m<n && s[m].start<s[k].end)                          //skipping un-selectable activity
        m++;
      if(m<n)                                                    //condition for selection
        {
          a[f]=s[m].id;                                          //keeping selected activity in a[]
          f++;
          activity_selector_recursive(m);                        //recursive call
        }
      else
        return;
  }
void activity_selector_iterative()                              //activity selector iterative
  {
      int i,b[n],z=0;
      b[z]=s[0].id;                                              //array for keeping selected id's
      z++;
      int k=0;
      for(i=1;i<n;i++)                                           //iterating throughout all activities
        {
          if(s[i].start >= s[k].end)                             //checking selection condition
```

```
            {
               b[z]=s[i].id;                                    //keeping selected activity in b[]
               k=i;
               z++;
            }
        }
      print(b,z);
   }
int main()
   {
      int i,j;
      clock_t start,stop;                                       //variables for timing analysis
      double duration;
      srand(time(0));
      for(i=0;i<n;i++)                                          //random activity generator
        {
        s[i].id=i+1;
        s[i].start=rand()%20;
        s[i].end=s[i].start+1+rand()%20;
        }
      print();
      random_quick_sort(0,n-1);                                 //sorting the activities
      print();
      cout<<"Recursive \n";
      start=clock();
      activity_selector_recursive(0);                           //call to recursive version
      print(a,f);
      stop=clock();
      duration=((double)(stop-start)/CLOCKS_PER_SEC);
      printf("time taken=%f sec\n",duration);
      cout<<"Iterative \n";
      start=clock();
      activity_selector_iterative();                            //call to iterative version
      stop=clock();
      duration=((double)(stop-start)/CLOCKS_PER_SEC);
      printf("time taken=%f sec\n",duration);
   }
```

Output:



```
kshitij@kshitij:~/Documents/DAA/lab8$ ./a.out
<start, end>
<14, 33> <16, 33> <10, 21> <6, 9> <4, 5> <15, 16> <8, 17> <15, 25> <12, 20> <12, 17>
<start, end>
<4, 5> <6, 9> <15, 16> <12, 17> <8, 17> <12, 20> <10, 21> <15, 25> <16, 33> <14, 33>
Recursive
<start, end>
<4, 5> <6, 9> <15, 16> <16, 33>
time taken=0.000031 sec
Iterative
<start, end>
<4, 5> <6, 9> <15, 16> <16, 33>
time taken=0.000024 sec
kshitij@kshitij:~/Documents/DAA/lab8$ ./a.out
<start, end>
<10, 29> <5, 24> <13, 15> <16, 32> <9, 29> <11, 22> <5, 13> <17, 24> <3, 11> <6, 23>
<start, end>
<3, 11> <5, 13> <13, 15> <11, 22> <6, 23> <17, 24> <5, 24> <9, 29> <10, 29> <16, 32>
Recursive
<start, end>
<3, 11> <13, 15> <17, 24>
time taken=0.000029 sec
Iterative
<start, end>
<3, 11> <13, 15> <17, 24>
time taken=0.000040 sec
kshitij@kshitij:~/Documents/DAA/lab8$
```



```
kshitij@kshitij:~/Documents/DAA/lab8$ ./a.out
<start, end>
<5, 19> <6, 8> <2, 18> <13, 23> <10, 23> <19, 33> <6, 12> <13, 27> <5, 7> <7, 12>
<start, end>
<5, 7> <6, 8> <7, 12> <6, 12> <2, 18> <5, 19> <13, 23> <10, 23> <13, 27> <19, 33>
Recursive
<start, end>
<5, 7> <7, 12> <13, 23>
time taken=0.000014 sec
Iterative
<start, end>
<5, 7> <7, 12> <13, 23>
time taken=0.000012 sec
kshitij@kshitij:~/Documents/DAA/lab8$ ./a.out
<start, end>
<5, 17> <19, 25> <0, 10> <7, 16> <0, 16> <17, 31> <8, 10> <0, 9> <19, 35> <9, 17>
<start, end>
<0, 9> <8, 10> <0, 10> <7, 16> <0, 16> <9, 17> <5, 17> <19, 25> <17, 31> <19, 35>
Recursive
<start, end>
<0, 9> <9, 17> <19, 25>
time taken=0.000014 sec
Iterative
<start, end>
<0, 9> <9, 17> <19, 25>
time taken=0.000014 sec
kshitij@kshitij:~/Documents/DAA/lab8$
```