

Lab 9

Function	Big O
<pre> struct student { char rollNo[20]; char emailId[35]; char lecture[3]; char tutorial[3]; char practical[3]; struct student*left; struct student*right; }; </pre>	<p>O(1)[Declaration] O(1)</p>
<pre> struct student*createNode(struct student buffer) { struct student*ptr=(struct student*)malloc(sizeof(struct student)); strcpy(ptr->rollNo,buffer.rollNo); strcpy(ptr->emailId,buffer.emailId); strcpy(ptr->lecture,buffer.lecture); strcpy(ptr->tutorial,buffer.tutorial); strcpy(ptr->practical,buffer.practical); ptr->left=NULL; ptr->right=NULL; return ptr; } </pre>	<p>O(1)[memory allocation]</p> <p> } O(1)[strcpy function] </p> <p>O(1)[making ptr next to null]</p> <p>O(1)[return stmt] O(1)</p>
<pre> int insertNode(struct student**startPtr,struct student*temp) { struct student* a = *startPtr; if(*startPtr==NULL) { *startPtr = temp; return 1; } struct student* st = *startPtr; struct student* pr; while(st!=NULL) { if(strcmp(st->rollNo,temp- >rollNo)==0) return 0; if(strcmp(st->rollNo,temp- >rollNo)>0) { pr = st; st=st->left; } else if(strcmp(st->rollNo,temp- >rollNo)<0) { </pre>	<p>O(h)[while loop will traverse through the tree where h is height of BST, in worst case h=n]</p>

<pre> pr = st; st=st->right; } } if(strcmp(pr->rollNo,temp->rollNo)>0) pr->left=temp; else pr->right = temp; return 1; } </pre>	<p>O(n)</p>
<pre> int deleteNode(struct student**ptr,char rollNumber[20]) { struct student* head = *ptr; if(strcmp(head- >rollNo,rollNumber)==0) { struct student* hr = head- >right; while(hr->left!=NULL) { hr = hr->left; } hr->left = head->left; struct student* temp = *ptr; *ptr = head->right; free(temp); return 1; } struct student* st = *ptr; struct student* pr; while(st!=NULL) { if(strcmp(st- >rollNo,rollNumber)==0) break; if(strcmp(st- >rollNo,rollNumber)>0) { pr = st; st=st->left; } else { pr = st; st=st->right; } } if(st==NULL) return 0; //printf("%s %s %s",st->rollNo,st- >right,st->left->rollNo); if(st->right==NULL && st->left==NULL) { if(pr->right==st) pr- >right=NULL; </pre>	<p>O(n)[The worst case time complexity of delete operation is O(h) where h is the height of the Binary Search Tree. In worst case, we may have to travel from the root to the deepest leaf node. The height of a skewed tree may become n and the time complexity of delete operation may become O(n)]</p>


<pre> else if(pr->left==st) pr- >left=NULL; free(st); return 1; } if(st->right==NULL && st->left!=NULL) { if(pr->right==st) pr->right=st- >left; else if(pr->left==st) pr->left=st- >left; free(st); return 1; } if(st->right!=NULL && st->left==NULL) { if(pr->right==st) pr->right=st- >right; else if(pr->left==st) pr->left=st- >right; free(st); return 1; } if(st->right!=NULL && st->left!=NULL) { struct student* pred = st->left; struct student* parent = st; while(pred->right!=NULL) { parent=pred; pred=pred->right; } if(pred==parent->right) parent->right=pred- >left; else parent->left=pred- >left; if(pr->left==st) pr->left = pred; pred->left = st->left; pred->right = st->right; free(st); return 1; } } </pre>	<p>O(n)</p>
<pre> int searchNode(struct student*ptr,char rollNumber[20]) { int i=1; if(ptr==NULL) return 0; while(ptr!=NULL) { if(strcmp(ptr- >rollNo,rollNumber)==0) </pre>	<p>O(n)[while loop may traverse till the end of BST]</p>

<pre> return i; if(strcmp(ptr- >rollNo,rollNumber)>0) ptr = ptr->left; else ptr = ptr->right; i++; } } </pre>	<p>O(n)</p>
<pre> int displayBST(struct student*start) { if(start==NULL) return 0; displayBST(start->left); printf("%s %s\n",start->rollNo,start- >emailId); displayBST(start->right); return ++tot; } </pre>	<p>O(n)[as it visits every node]</p> <p>O(n)</p>

```
[2019A7PS0020U@linuxbpdc1 Week_09]$ ls
a.out listWrapper.c testCaseForBST.txt testResult.txt
[2019A7PS0020U@linuxbpdc1 Week_09]$ cc listWrapper.c
[2019A7PS0020U@linuxbpdc1 Week_09]$ a.out
2018A7PS0032U F20180032@DUBAI.BITS-PILANI.AC.IN
2019A7PS0015U F20190015@DUBAI.BITS-PILANI.AC.IN
2019A7PS0016U F20190016@DUBAI.BITS-PILANI.AC.IN
2019A7PS0020U F20190020@DUBAI.BITS-PILANI.AC.IN
2019A7PS0022U F20190022@DUBAI.BITS-PILANI.AC.IN
2019A7PS0047U F20190047@DUBAI.BITS-PILANI.AC.IN
2019A7PS0052U F20190052@DUBAI.BITS-PILANI.AC.IN
2019A7PS0053U F20190053@DUBAI.BITS-PILANI.AC.IN
2019A7PS0084U F20190084@DUBAI.BITS-PILANI.AC.IN
2019A7PS0089U F20190089@DUBAI.BITS-PILANI.AC.IN
2019A7PS0101U F20190101@DUBAI.BITS-PILANI.AC.IN
2019A7PS0106U F20190106@DUBAI.BITS-PILANI.AC.IN
2019A7PS0110U F20190110@DUBAI.BITS-PILANI.AC.IN
2019A7PS0112U F20190112@DUBAI.BITS-PILANI.AC.IN
2019A7PS0115U F20190115@DUBAI.BITS-PILANI.AC.IN
2019A7PS0120U F20190120@DUBAI.BITS-PILANI.AC.IN
2019A7PS0124U F20190124@DUBAI.BITS-PILANI.AC.IN
2019A7PS0145U F20190145@DUBAI.BITS-PILANI.AC.IN
2019A7PS0155U F20190155@DUBAI.BITS-PILANI.AC.IN
2019A7PS0160U F20190160@DUBAI.BITS-PILANI.AC.IN
2019A7PS0170U F20190170@DUBAI.BITS-PILANI.AC.IN
2019A7PS0172U F20190172@DUBAI.BITS-PILANI.AC.IN
2019A7PS0179U F20190179@DUBAI.BITS-PILANI.AC.IN
2019A7PS0182U F20190182@DUBAI.BITS-PILANI.AC.IN
2019A7PS0184U F20190184@DUBAI.BITS-PILANI.AC.IN
2019A7PS0195U F20190195@DUBAI.BITS-PILANI.AC.IN
2019A7PS0196U F20190196@DUBAI.BITS-PILANI.AC.IN
2019A7PS0201U F20190201@DUBAI.BITS-PILANI.AC.IN
2019A7PS0213U F20190213@DUBAI.BITS-PILANI.AC.IN
2019A7PS0267U F20190267@DUBAI.BITS-PILANI.AC.IN

Total count=30
[2019A7PS0020U@linuxbpdc1 Week_09]$
```

```
Telnet 172.16.22.5
1 Details for 2019A7PS0086U successfully inserted
2 2019A7PS0086U present at location 1
3 Details for 2019A7PS0083U successfully inserted
4 2019A7PS0083U present at location 2
5 Details for 2019A7PS0172U successfully inserted
6 Details for 2019A7PS0087U successfully inserted
7 Deletion successfull 2019A7PS0172U successfully removed
8 Details for 2019A7PS0140U successfully inserted
9 2019A7PS0083U present at location 2
10 Details for 2019A7PS0266U successfully inserted
11 Deletion successfull 2019A7PS0266U successfully removed
12 Details for 2019A7PS0100U successfully inserted
13 Details for 2019A7PS0184U successfully inserted
14 Details for 2019A7PS0042U successfully inserted
15 Deletion successfull 2019A7PS0042U successfully removed
16 Details for 2019A7PS0089U successfully inserted
17 Details for 2019A7PS0015U successfully inserted
18 Deletion Failed: 2019A7PS0167U not present in BST
19 Deletion successfull 2019A7PS0083U successfully removed
20 Details for 2019A7PS0262U successfully inserted
21 2019A7PS0086U present at location 1
22 Details for 2019A7PS0112U successfully inserted
23 Deletion successfull 2019A7PS0100U successfully removed
24 Details for 2019A7PS0016U successfully inserted
25 Deletion successfull 2019A7PS0262U successfully removed
26 Details for 2018A7PS0032U successfully inserted
27 Details for 2019A7PS0155U successfully inserted
28 Details for 2019A7PS0106U successfully inserted
29 Details for 2019A7PS0260U successfully inserted
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 Telnet 172.16.22.5

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27 Details for 2019A7PS0155U successfully inserted
28 Details for 2019A7PS0106U successfully inserted
29 Details for 2019A7PS0260U successfully inserted
30 Details for 2019A7PS0047U successfully inserted
31 Deletion Failed: 2019A7PS0049U not present in BST
32 Deletion successfull 2019A7PS0260U successfully removed
33 2019A7PS0140U present at location 3
34 Details for 2019A7PS0196U successfully inserted
35 Details for 2019A7PS0172U successfully inserted
36 Details for 2019A7PS0052U successfully inserted
37 Details for 2019A7PS0110U successfully inserted
38 Deletion successfull 2019A7PS0086U successfully removed
39 Details for 2019A7PS0044U successfully inserted
40 Details for 2019A7PS0101U successfully inserted
41 2019A7PS0140U present at location 2
42 Details for 2019A7PS0053U successfully inserted
43 2019A7PS0064U not present in BST
44 Details for 2019A7PS0076U successfully inserted
45 Details for 2019A7PS0182U successfully inserted
46 Deletion successfull 2019A7PS0044U successfully removed
47 Details for 2019A7PS0022U successfully inserted
48 Details for 2019A7PS0201U successfully inserted
49 2019A7PS0047U present at location 4
50 2019A7PS0101U present at location 6
51 Details for 2019A7PS0195U successfully inserted
52 Deletion successfull 2019A7PS0076U successfully removed
53 Deletion successfull 2019A7PS0087U successfully removed
54 Deletion successfull 2019A7PS0140U successfully removed
55 2019A7PS0089U present at location 3
```

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53 Deletion successfull 2019A7PS0087U successfully removed
54 Deletion successfull 2019A7PS0140U successfully removed
55 2019A7PS0089U present at location 3
56 2019A7PS0155U present at location 2
57 Details for 2019A7PS0124U successfully inserted
58 Details for 2019A7PS0267U successfully inserted
59 2019A7PS0016U present at location 5
60 Details for 2019A7PS0115U successfully inserted
61 Details for 2019A7PS0120U successfully inserted
62 Details for 2019A7PS0145U successfully inserted
63 Details for 2019A7PS0170U successfully inserted
64 Details for 2019A7PS0020U successfully inserted
65 Details for 2019A7PS0179U successfully inserted
66 Details for 2019A7PS0084U successfully inserted
67 Details for 2019A7PS0160U successfully inserted
68 2019A7PS0145U present at location 6
69 2019A7PS0267U present at location 4
70 Details for 2019A7PS0213U successfully inserted
```