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name1 lname1 22211 77 Math 1	
name2 lname2 12212 78 Math 1	
name3 lname3 22213 79 physics 1	
name5	
name4 lname4 12214 77 Math 0	
Traine : Litame : Lillian :	

name6 lname6 12216 66 Math 1
Data.txt file content

## MAIN OPTIONS

```
******* CE 368, C Data Structures, Lists, Qeues, Binary Trees, Stacks ********
 ====== Student File was read into Array with Content:
                           22211
    name1
              lname1
                                             Math
    name2
               lname2
                           12212
                                             Math
                                    78
    name3
               lname3
                           22213
                                    79
                                          physics
                                                      1
                                          physics
    name5
               lname5
    name7
               lname7
                           22217
                                    58
                                             Math
    name4
               lname4
                           12214
                                             Math
                                                      0
    name6
               lname6
                           12216
                                             Math
*********MAIN MENU ********
9: Exit
1:Linked List Menu
2:Doubly Linked List Menu
:Linked Queue Menu
4:Doubly Linked Stack Menu
:Binary Tree Menu
input a choice:
```

Figure 1: initial running the program, showing the content of the file read stored in array and presenting user options

## LINKED LIST OPTIONS

```
**********MAIN MENU ********
0: Exit
1:Linked List Menu
2:Doubly Linked List Menu
3:Linked Queue Menu
4:Doubly Linked Stack Menu
5:Binary Tree Menu
input a choice:1
***LIST MENU ***
0: Return To Main Menu

    Create a Linked List of all students.

2: View the linked list
3: Insert New Student
Delete a student with specific ID.
Delete all student with GPA less than the GPA entered by the user.
input a choice:1
Linked List Created ...
```

Figure 2: list menu and creation option

```
***LIST MENU ***
0: Return To Main Menu

    Create a Linked List of all students.

2: View the linked list
3: Insert New Student
Delete a student with specific ID.
Delete all student with GPA less than the GPA entered by the user.
input a choice:2
lname6
                      12216
                             66
    name6
                                    Math
            lname4
                      12214
                             77
                                            0
    name4
                                    Math
            lname7
                      22217
                             58
    name7
                                    Math
                                            1
    name5
            lname5
                      22215
                             78
                                            0
                                  physics
                      22213 79
            lname3
                                  physics
    name3
    name2
            lname2
                      12212
                             78
                                    Math
                                            1
                                     Math
    name1
            lname1
                      22211
                                            1
   _____
```

Figure 3: view list

```
***LIST MENU ***
0: Return To Main Menu

    Create a Linked List of all students.

2: View the linked list
3: Insert New Student
Delete a student with specific ID.
Delete all student with GPA less than the GPA entered by the user.
input a choice:3
input first name:testname
input last name:testlastname
input id:22
input GPA:55
input major:it
input insurance status (1 for insured) (0 for uninsured):0
***LIST MENU ***
0: Return To Main Menu

    Create a Linked List of all students.

2: View the linked list
3: Insert New Student
Delete a student with specific ID.
5: Delete all student with GPA less than the GPA entered by the user.
input a choice:2
------ Linked list ------
  testname testlastname
                                                it
                                                       0
              lname6
                          12216
                                   66
                                                     1
    name6
                                            Math
    name4
              lname4
                          12214
                                   77
                                            Math
                                                     0
              lname7
    name7
                          22217
                                   58
                                            Math
              lname5
                                   78
    name5
                          22215
                                         physics
                                                     0
                                         physics
              lname3
                          22213
                                   79
                                                     1
    name3
    name2
              lname2
                          12212
                                   78
                                            Math
                                                     1
              lname1
                                   77
     name1
                          22211
                                            Math
                                                     1
```

Figure 4: dynamic adding of new element to the list, note that the original array wont change

```
***LIST MENU ***
0: Return To Main Menu

    Create a Linked List of all students.

2: View the linked list
3: Insert New Student
4: Delete a student with specific ID.
5: Delete all student with GPA less than the GPA entered by the user.
input a choice:4
input student id:22215
student record with id [22215] was deleted from linked list
***LIST MENU ***
0: Return To Main Menu

    Create a Linked List of all students.

2: View the linked list
3: Insert New Student
Delete a student with specific ID.
5: Delete all student with GPA less than the GPA entered by the user.
input a choice:2
============= Linked list ===============
 testname testlastname
                              22
                                    55
                                               it
                                                      0
              lname6
                          12216
                                  66
                                           Math
                                                    1
    name6
              lname4
                          12214
                                  77
                                                    0
    name4
                                           Math
    name7
              lname7
                          22217
                                  58
                                           Math
                                                    1
              lname3
                          22213
                                  79
                                                    1
    name3
                                        physics
              lname2
                                  78
    name2
                          12212
                                           Math
                                                    1
    name1
              lname1
                          22211
                                  77
                                           Math
                                                    1
 ------
```

Figure 5: deleting student with id 22215 and viewing the list again to confirm

```
***LIST MENU ***
0: Return To Main Menu

    Create a Linked List of all students.

2: View the linked list
3: Insert New Student
Delete a student with specific ID.
5: Delete all student with GPA less than the GPA entered by the user.
input a choice:5
input GPA:70
student record with id [22] gpa [55] was deleted from linked list
student record with id [12216] gpa [66] was deleted from linked list
student record with id [22217] gpa [58] was deleted from linked list
***LIST MENU ***
0: Return To Main Menu

    Create a Linked List of all students.

2: View the linked list
3: Insert New Student
4: Delete a student with specific ID.
Delete all student with GPA less than the GPA entered by the user.
input a choice:2
 ============= Linked list ===============
    name4
              lname4
                         12214
                                  77
                                          Math
                                                   0
                                  79
    name3
              1name3
                         22213
                                                   1
                                       physics
                         12212
                                  78
    name2
              lname2
                                          Math
                                                   1
    name1
              lname1
                         22211
                                  77
                                          Math
 ------
```

Figure 6: deleting students with GPA less than certain value, showing updated list

## Double LINKED LIST OPTIONS

```
***Doubly Linked LIST MENU ***
0: Return To Main Menu

    Create a Doubly Linked List of all students.

View the Doubly Linked List.
3: Insert New Student
Delete a student whose name is specified by the user.
Delete all students that don®t have health insurance.
input a choice:1
Double Linked List Created ...
***Doubly Linked LIST MENU ***
0: Return To Main Menu

    Create a Doubly Linked List of all students.

View the Doubly Linked List.
3: Insert New Student

    Delete a student whose name is specified by the user.

Delete all students that don®t have health insurance.
input a choice:2
----- Double Linked list -----
              lname6
                         12216
                                  66
    name6
                                           Math
                                                   1
                                           Math
    name4
              lname4
                          12214
                                  77
                                                   0
              lname7
    name7
                          22217
                                  58
                                           Math
                                                   1
                         22215 78 physics
    name5
             lname5
                                                   0
    name3
             lname3
                          22213 79
                                        physics
                                                   1
              lname2
                          12212
                                  78
                                           Math
                                                   1
    name2
              lname1
                          22211
                                  77
                                                   1
    name1
                                           Math
***Doubly Linked LIST MENU ***
0: Return To Main Menu
```

Figure 7: double linked list created from original student array

```
***Doubly Linked LIST MENU ***
0: Return To Main Menu

    Create a Doubly Linked List of all students.

View the Doubly Linked List.
3: Insert New Student
Delete a student whose name is specified by the user.
5: Delete all students that don⊡t have health insurance.
input a choice:4
input student first name:name2
input student last name:lname2
student record with name [name2 lname2] was deleted from double linked list
***Doubly Linked LIST MENU ***
0: Return To Main Menu
1: Create a Doubly Linked List of all students.
View the Doubly Linked List.
3: Insert New Student

    Delete a student whose name is specified by the user.

Delete all students that don@t have health insurance.
input a choice:2
----- Double Linked list ------
                                 66
                         12216
    name6
              lname6
                                           Math
              lname4
                         12214
                                  77
                                                   0
    name4
                                           Math
    name7
              lname7
                         22217
                                  58
                                           Math
    name5
              1name5
                         22215
                                  78
                                        physics
                                                   0
              lname3
    name3
                          22213
                                  79
                                        physics
                                                   1
    name1
              lname1
                          22211
                                           Math
                                                   1
 ------
```

Figure 8: deleting a student using first and last name

```
***Doubly Linked LIST MENU ***
0: Return To Main Menu

    Create a Doubly Linked List of all students.

View the Doubly Linked List.
3: Insert New Student

    Delete a student whose name is specified by the user.

5: Delete all students that don⊡t have health insurance.
input a choice:5
student with id [12214] with no health insurance was deleted from double linked list student with id [22215] with no health insurance was deleted from double linked list
***Doubly Linked LIST MENU ***
0: Return To Main Menu
1: Create a Doubly Linked List of all students.
2: View the Doubly Linked List.
3: Insert New Student

    Delete a student whose name is specified by the user.

Delete all students that don@t have health insurance.
input a choice:2
     ----- Double Linked list -----
                             12216
                                               Math
     name6
               lname6
                                      58
     name7
                1name7
                             22217
                                               Math
     name3
                lname3
                             22213
                                             physics
     name1
                lname1
                             22211
                                               Math
  ------
```

Figure 9: delete uninsured students

## Linked Queue Options

```
***Linked Queue MENU ***
0: Return To Main Menu
1: Create a Linked Queue of all students from the highest ID to the lowest.
2: View the Linked Queue.
3: Enqueue.
4: Dequeue.
input a choice:1
Ordered Queue Created ...
***Linked Queue MENU ***
0: Return To Main Menu

    Create a Linked Queue of all students from the highest ID to the lowest.

View the Linked Queue.
Enqueue.
4: Dequeue.
input a choice:2
58
              lname7
                          22217
                                           Math
                                                    1
    name7
              1name5
                          22215
                                  78
                                                    0
    name5
                                        physics
    name3
              lname3
                          22213
                                  79
                                        physics
                                  77
    name1
              lname1
                          22211
                                           Math
    name6
              lname6
                          12216
                                  66
                                           Math
                                  77
                                                    0
    name4
              lname4
                          12214
                                           Math
                                                    1
    name2
              lname2
                          12212
                                  78
                                           Math
```

Figure 10: ordered queue created, sorted by id from highest to lowest

```
input a choice:4
Dequeue of:
                            lname5
                                         22215
                  name5
                                                  78
                                                        physics
                                                                    0
Wrong Input (choose 0..4)
***Linked Queue MENU ***
0: Return To Main Menu
1: Create a Linked Queue of all students from the highest ID to the lowest.
2: View the Linked Queue.
Enqueue.
4: Dequeue.
input a choice:4
Dequeue of:
                            lname3
                                         22213
                                                  79
                  name3
                                                        physics
Wrong Input (choose 0..4)
***Linked Queue MENU ***
0: Return To Main Menu
1: Create a Linked Queue of all students from the highest ID to the lowest.
2: View the Linked Queue.
3: Enqueue.
4: Dequeue.
input a choice:4
                  name1
                            lname1
                                         22211
                                                           Math
Dequeue of:
Wrong Input (choose 0..4)
***Linked Queue MENU ***
0: Return To Main Menu
1: Create a Linked Queue of all students from the highest ID to the lowest.
2: View the Linked Queue.
3: Enqueue.
4: Dequeue.
input a choice:2
 =============== Ordered Qeueu===============
                           12216
                                    66
                                             Math
     name6
               lname6
     name4
               lname4
                           12214
                                              Math
                                                       0
    name2
               lname2
                                    78
                                              Math
```

Figure 11: sample dequeue of some students

```
Create a Doubly Linked Stack of all students from the highest GPA to the lowest.
: View the Doubly Linked Stack.
: Push.
4: Pop.
input a choice:3
input first name:pushname
nput last name:pushlname
input id:432
input GPA:66
input major:asdf
input insurance status (1 for insured) (0 for uninsured):1
**Doubly Linked Stack MENU ***
0: Return To Main Menu
: Create a Doubly Linked Stack of all students from the highest GPA to the lowest.
: View the Doubly Linked Stack.
: Push.
: Pop.
input a choice:2
------ Ordered by GPA Double Linked Stack-----
              lname3
                          22213
                                         physics
    name3
    name2
              lname2
                          12212
                                   78
                                            Math
    name5
              lname5
                          22215
                                         physics
                                                     0
              lname1
                          22211
                                            Math
    name1
    name6
              lname6
                          12216
                                   66
                                            Math
 pushname
           pushlname
                           432
                                   66
                                            asdf
                          22217
                                   58
    name7
              lname7
                                            Math
**Doubly Linked Stack MENU ***
: Return To Main Menu
  Create a Doubly Linked Stack of all students from the highest GPA to the lowest.
: View the Doubly Linked Stack.
: Push.
: Pop.
nput a choice:
```

Figure 12: double linked stack menu, push example

```
View the Doubly Linked Stack.
3: Push.
4: Pop.
input a choice:3
input first name:pushtop
input last name:pushtoplname
input id:43243
input GPA:88
input major:sadf
input insurance status (1 for insured) (0 for uninsured):1
***Doubly Linked Stack MENU ***
0: Return To Main Menu
1: Create a Doubly Linked Stack of all students from the highest GPA to the lowest.
2: View the Doubly Linked Stack.
3: Push.
1: Pop.
input a choice:2
   ======= Ordered by GPA Double Linked Stack=====
                              43243
   pushtop pushtoplname
                                        88
                                                   sadf
                             22213
                                        79
                                              physics
     name3
                lname3
     name2
                lname2
                              12212
                                                 Math
                                       78
77
                                              physics
     name5
                lname5
                             22215
                                                           0
     name1
                lname1
                             22211
                                                 Math
     name6
                lname6
                              12216
                                       66
                                                 Math
                                       66
                                                 asdf
  pushname
             pushlname
                lname7
                             22217
                                       58
     name7
                                                 Math
```

Figure 13: push top example

```
0: Return To Main Menu
1: Create a Doubly Linked Stack of all students from the highest GPA to the lowest.
View the Doubly Linked Stack.
3: Push.
4: Pop.
input a choice:4
Dequeue of:
               pushtop pushtoplname
                                          43243
                                                   88
                                                            sadf
Wrong Input (choose 0..5)
***Doubly Linked Stack MENU ***
0: Return To Main Menu

    Create a Doubly Linked Stack of all students from the highest GPA to the lowest.
    View the Doubly Linked Stack.

3: Push.
4: Pop.
input a choice:4
                            lname3
                                        22213
                                                 79
                                                       physics
Dequeue of:
                 name3
Wrong Input (choose 0..5)
***Doubly Linked Stack MENU ***
0: Return To Main Menu

    Create a Doubly Linked Stack of all students from the highest GPA to the lowest.
    View the Doubly Linked Stack.

3: Push.
4: Pop.
input a choice:4
                 name2
                            lname2
                                        12212
                                                 78
Dequeue of:
                                                          Math
Wrong Input (choose 0..5)
***Doubly Linked Stack MENU ***
0: Return To Main Menu
1: Create a Doubly Linked Stack of all students from the highest GPA to the lowest.
View the Doubly Linked Stack.
3: Push.
4: Pop.
input a choice:2
name5
               lname5
                           22215
                                    78
                                          physics
                                                      0
                           22211
                                             Math
    name1
               lname1
               lname6
                           12216
                                    66
                                             Math
    name6
                                             asdf
           pushlname
                                    66
  pushname
    name7
              lname7
                           22217
                                    58
                                             Math
```

Figure 14: pop examples

```
***BINARY TREE MENU ***
0: Return To Main Menu
1: Convert the array of Students into a balanced left justified binary tree.
2: View the sequence of nodes (student names) of the binary tree in pre-order.3: View the sequence of nodes (student names) of the binary tree in post-order.
4: Generate the adjacency matrix of the binary tree.
input a choice:1
Binary Tree was Created ...
***BINARY TREE MENU ***
0: Return To Main Menu
1: Convert the array of Students into a balanced left justified binary tree.
2: View the sequence of nodes (student names) of the binary tree in pre-order.3: View the sequence of nodes (student names) of the binary tree in post-order.
4: Generate the adjacency matrix of the binary tree.
input a choice:2
[name3 lname3]
name2 lname2
 name1 lname1
 name5 lname5]
 name4 lname41
 name7 lname7]
name6 lname6
***BINARY TREE MENU ***
0: Return To Main Menu
1: Convert the array of Students into a balanced left justified binary tree.
2: View the sequence of nodes (student names) of the binary tree in pre-order.
3: View the sequence of nodes (student names) of the binary tree in post-order.
4: Generate the adjacency matrix of the binary tree.
input a choice:
```

Figure 15: binary tree creation and preorder view (ordering is based on fname)

```
***BINARY TREE MENU ***
0: Return To Main Menu
1: Convert the array of Students into a balanced left justified binary tree.

    View the sequence of nodes (student names) of the binary tree in pre-order.
    View the sequence of nodes (student names) of the binary tree in post-order.

4: Generate the adjacency matrix of the binary tree.
input a choice:2
 name3 lname3]
 name2 lname2]
 name1 lname1
 name5 lname5
 name4 lname4]
 name7 lname7
 name6 lname6]
 ***BINARY TREE MENU ***
0: Return To Main Menu
1: Convert the array of Students into a balanced left justified binary tree.
2: View the sequence of nodes (student names) of the binary tree in pre-order.
3: View the sequence of nodes (student names) of the binary tree in post-order.
4: Generate the adjacency matrix of the binary tree.
input a choice:3
[name1 lname1]
 name2 lname2
 name4 lname4]
 name6 lname6]
 name7 lname7
 name5 lname5
 name3 lname3]
```

Figure 16: post order print of left balanced binary tree

```
[name4 lname4]
[name6 lname6]
[name7 lname7]
name5 lname5
name3 lname3]
***BINARY TREE MENU ***
0: Return To Main Menu
1: Convert the array of Students into a balanced left justified binary tree.
2: View the sequence of nodes (student names) of the binary tree in pre-order.
View the sequence of nodes (student names) of the binary tree in post-order.
4: Generate the adjacency matrix of the binary tree.
input a choice:4
adjacency matrix generated from the binary tree:
0 0 0 0 0 0 0
1000000
0101000
0000110
0000001
000000
0000000
***BINARY TREE MENU ***
```

Figure 17: adjacency matrix