

Problem Definition

You implement a sorted multilevel linked list which keeps web browser's history. This sorted multilevel linked list is a 2D structure. The first dimension keeps the date(Date Node), the second dimension keeps the time and site name(TSite Node). Each horizontal node in a multilevel linked list has next, previous and up pointer and each vertical node has up pointer. These nodes are represented as:

Code Listing 1: MultiNode.h

```
class TSiteNode{
private:
    string time;
    string site_name;
    TSiteNode* up;
public:
    TSiteNode(string, string);
    void set_time(string);
    string get_time();
    void set_site_name(string);
    string get_site_name();
    void set_up(TSiteNode*);
    TSiteNode* get_up();
};

class DateNode{
private:
    string date;
    DateNode* next;
    DateNode* prev;
    TSiteNode* up;

public:
    DateNode(string);
    void set_date(string);
    string get_date();
    void set_next(DateNode*);
    DateNode* get_next();
    void set_prev(DateNode*);
    DateNode* get_prev();
    void set_up(TSiteNode*);
    TSiteNode* get_up();
};
```

add_node and remove_node functions are completed in MultiList.cpp file. The list must be sorted horizontally by date and vertically by time. Apart from these, **you can(should) add new functions but please**

don't change MultiList(), ~MultiList(), print_list() functions. Multilevel linked list is represented as:

Code Listing 2: MultiList.h

```
#include "MultiNode.h"

class MultiList{
    private:
        DateNode* head;
        DateNode* tail;

    public:
        MultiList();
        ~MultiList();
        void add_node(string, string, string);
        void remove_node(string, string);
        void print_list();
        //You can add any function.
};
```

You should do following transformation in these functions:

- void add_node(string date, string time, string site_name)
 - You are taken web site's name, date and time from the user. You add this record to sorted multilevel linked list by date and time.
 - If the date node is already created, you should not create a date horizontally and add this record up to this node by time.
- void remove_node(string date, string time)
 - You are taken date and time from the user. You delete this record from sorted multilevel linked list by date and time.
 - Even if all web site records are related to that date node are deleted, related date node should not be deleted.
 - Record of the non-existent website will not be requested to be deleted.

1 Example

Terminal Screen

```
Choose an operation
Choose an operation
A: Add a website record to web browser history
D: Delete a website record from web browser history
P: Print the web browser history
E: Exit
Enter a choice A,D,P,E: A
Enter the website name:itu.edu.tr
Enter the date with yyyy-mm-dd HH:MM:SS format:2022/03/14 15:00:00
Choose an operation
A: Add a website record to web browser history
D: Delete a website record from web browser history
P: Print the web browser history
E: Exit
Enter a choice A,D,P,E: A
```

Enter the website name:ninova.itu.edu.tr
Enter the date with yyyy-mm-dd HH:MM:SS format:2022/03/14 12:00:00
Choose an operation
A: Add a website record to web browser history
D: Delete a website record from web browser history
P: Print the web browser history
E: Exit
Enter a choice A,D,P,E: A
Enter the website name:bidb.itu.edu.tr
Enter the date with yyyy-mm-dd HH:MM:SS format:2022/03/14 14:00:00
Choose an operation
A: Add a website record to web browser history
D: Delete a website record from web browser history
P: Print the web browser history
E: Exit
Enter a choice A,D,P,E: A
Enter the website name:webmail.itu.edu.tr
Enter the date with yyyy-mm-dd HH:MM:SS format:2022/03/14 13:00:00
Choose an operation
A: Add a website record to web browser history
D: Delete a website record from web browser history
P: Print the web browser history
E: Exit
Enter a choice A,D,P,E: A
Enter the website name:sis.itu.edu.tr
Enter the date with yyyy-mm-dd HH:MM:SS format:2022/03/08 16:00:00
Choose an operation
A: Add a website record to web browser history
D: Delete a website record from web browser history
P: Print the web browser history
E: Exit
Enter a choice A,D,P,E: A
Enter the website name:portal.itu.edu.tr
Enter the date with yyyy-mm-dd HH:MM:SS format:2022/03/08 15:00:00
Choose an operation
A: Add a website record to web browser history
D: Delete a website record from web browser history
P: Print the web browser history
E: Exit
Enter a choice A,D,P,E: A
Enter the website name:kutuphane.itu.edu.tr
Enter the date with yyyy-mm-dd HH:MM:SS format:2022/03/08 14:00:00
Choose an operation
A: Add a website record to web browser history
D: Delete a website record from web browser history
P: Print the web browser history
E: Exit
Enter a choice A,D,P,E: A
Enter the website name:kepler-beta.itu.edu.tr
Enter the date with yyyy-mm-dd HH:MM:SS format:2022/03/08 13:00:00
Choose an operation
A: Add a website record to web browser history
D: Delete a website record from web browser history
P: Print the web browser history
E: Exit
Enter a choice A,D,P,E: A

Enter the website name:bbf.itu.edu.tr
Enter the date with yyyy-mm-dd HH:MM:SS format:2022/03/16 11:00:00
Choose an operation
A: Add a website record to web browser history
D: Delete a website record from web browser history
P: Print the web browser history
E: Exit
Enter a choice A,D,P,E: A
Enter the website name:bm.itu.edu.tr
Enter the date with yyyy-mm-dd HH:MM:SS format:2022/03/16 12:00:00
Choose an operation
A: Add a website record to web browser history
D: Delete a website record from web browser history
P: Print the web browser history
E: Exit
Enter a choice A,D,P,E: A
Enter the website name:lee.itu.edu.tr
Enter the date with yyyy-mm-dd HH:MM:SS format:2022/03/16 13:00:00
Choose an operation
A: Add a website record to web browser history
D: Delete a website record from web browser history
P: Print the web browser history
E: Exit
Enter a choice A,D,P,E: A
Enter the website name:akademi.itu.edu.tr
Enter the date with yyyy-mm-dd HH:MM:SS format:2022/03/16 14:00:00
Choose an operation
A: Add a website record to web browser history
D: Delete a website record from web browser history
P: Print the web browser history
E: Exit
Enter a choice A,D,P,E: A
Enter the website name:sks.itu.edu.tr
Enter the date with yyyy-mm-dd HH:MM:SS format:2022/03/15 17:00:00
Choose an operation
A: Add a website record to web browser history
D: Delete a website record from web browser history
P: Print the web browser history
E: Exit
Enter a choice A,D,P,E: A
Enter the website name:kim.itu.edu.tr
Enter the date with yyyy-mm-dd HH:MM:SS format:2022/03/15 11:00:00
Choose an operation
A: Add a website record to web browser history
D: Delete a website record from web browser history
P: Print the web browser history
E: Exit
Enter a choice A,D,P,E: A
Enter the website name:bap.itu.edu.tr
Enter the date with yyyy-mm-dd HH:MM:SS format:2022/03/15 12:30:00
Choose an operation
A: Add a website record to web browser history
D: Delete a website record from web browser history
P: Print the web browser history
E: Exit
Enter a choice A,D,P,E: A

```
Enter the website name:pdb.itu.edu.tr
Enter the date with yyyy-mm-dd HH:MM:SS format:2022/03/15 14:00:10
Choose an operation
A: Add a website record to web browser history
D: Delete a website record from web browser history
P: Print the web browser history
E: Exit
Enter a choice A,D,P,E: D
Enter the date with yyyy-mm-dd HH:MM:SS format:2022/03/14 13:00:00
Choose an operation
A: Add a website record to web browser history
D: Delete a website record from web browser history
P: Print the web browser history
E: Exit
Enter a choice A,D,P,E: D
Enter the date with yyyy-mm-dd HH:MM:SS format:2022/03/14 14:00:00
Choose an operation
A: Add a website record to web browser history
D: Delete a website record from web browser history
P: Print the web browser history
E: Exit
Enter a choice A,D,P,E: D
Enter the date with yyyy-mm-dd HH:MM:SS format:2022/03/16 12:00:00
Choose an operation
A: Add a website record to web browser history
D: Delete a website record from web browser history
P: Print the web browser history
E: Exit
Enter a choice A,D,P,E: A
Enter the website name:mezun.itu.edu.tr
Enter the date with yyyy-mm-dd HH:MM:SS format:2022/03/16 12:00:00
Choose an operation
A: Add a website record to web browser history
D: Delete a website record from web browser history
P: Print the web browser history
E: Exit
Enter a choice A,D,P,E: P
2022/03/08:
13:00:00->kepler-beta.itu.edu.tr
14:00:00->kutuphane.itu.edu.tr
15:00:00->portal.itu.edu.tr
16:00:00->sis.itu.edu.tr
2022/03/14:
12:00:00->ninova.itu.edu.tr
15:00:00->itu.edu.tr
2022/03/15:
11:00:00->kim.itu.edu.tr
12:30:00->bap.itu.edu.tr
14:00:10->pdb.itu.edu.tr
17:00:00->sks.itu.edu.tr
2022/03/16:
11:00:00->bbf.itu.edu.tr
12:00:00->mezun.itu.edu.tr
13:00:00->lee.itu.edu.tr
14:00:00->akademi.itu.edu.tr
```

Choose an operation
 A: Add a website record to web browser history
 D: Delete a website record from web browser history
 P: Print the web browser history
 E: Exit
 Enter a choice A,D,P,E:

After these operations, multilevel linked list should be as in the figure.

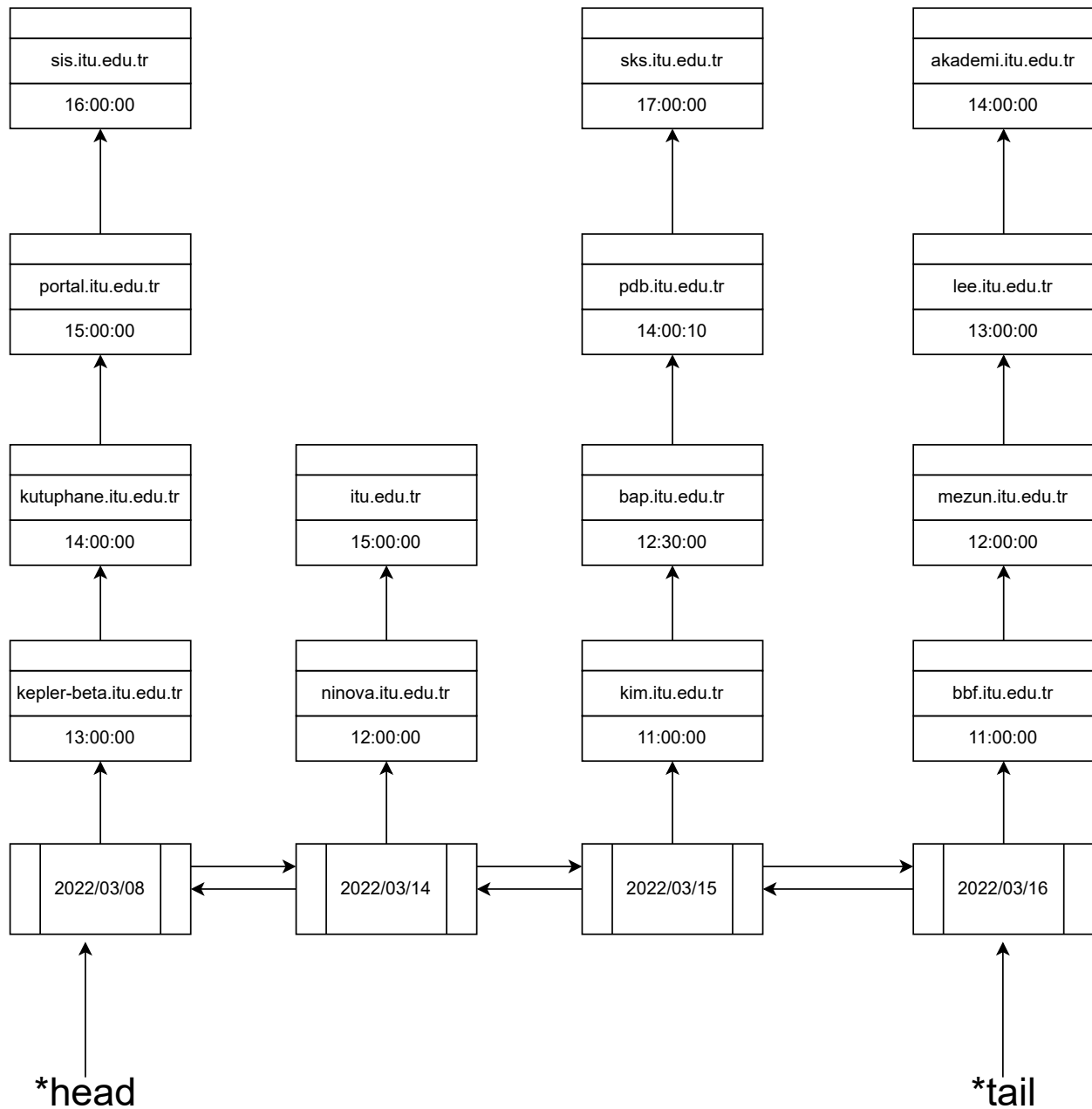


Figure 1: Sorted multilevel linked list.

Submission Rules

- Make sure you write your name and number in all of the files of your project, in the following format:

```
/* @Author
```

```
Student Name: <student_name>
```

```
Student ID : <student_id>
```

```
Date: <date> */
```

- Use comments wherever necessary in your code to explain what you did.
- Your program will be checked by using **Calico**(<https://bitbucket.org/uyar/calico>) automatic checker.
- Do not share any code or text that can be submitted as a part of an assignment (discussing ideas is okay).
- Only electronic submissions through Ninova will be accepted no later than deadline.
- You may discuss the problems at an abstract level with your classmates, but you should not **share or copy code** from your classmates or from the Internet. You should submit your **own, individual** homework.
- Academic dishonesty, including cheating, plagiarism, and direct copying, is unacceptable.
- If you have any question about the recitation, you can send e-mail to Yunus Emre Cebeci(cebeci16@itu.edu.tr).
- Note that **YOUR CODES WILL BE CHECKED WITH THE PLAGIARISM TOOLS!**



This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License.