Hacettepe University
Department of Computer Science & Engineering

BiL235 Programming/Software Laboratory
Experiment III

Subject : Data Structures
Date Due : 02.12.2011
Programming Language : ANSI C
Advisors : Asst. Prof. Dr. Mustafa EGE, R.A. Oğuzhan GÜÇLÜ

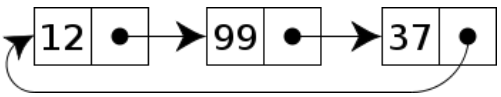
BACKGROUND INFORMATION

Linked Lists

Linked lists are among the simplest and most common data structures. They can be used to implement several other common abstract data structures including stacks, queues etc. A linked list has a group of nodes, and each node has a data and a reference to the next node.

Linear and Circular Linked Lists

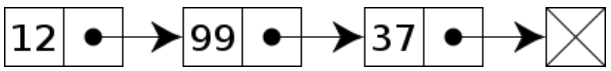
In the last node of a list, the link field often contains a null reference, a special value used to indicate the lack of further nodes. A less common convention is to make it point to the first node of the list; in that case the list is said to be circular or circularly linked; otherwise it is said to be open or linear.



A circular linked list

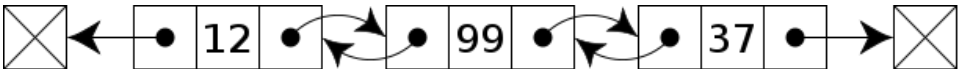
Singly and Doubly Linked Lists

Singly linked lists contain nodes which have a data field as well as a next field, which points to the next node in the linked list.



A singly linked list whose nodes contain two fields: an integer value and a link to the next node

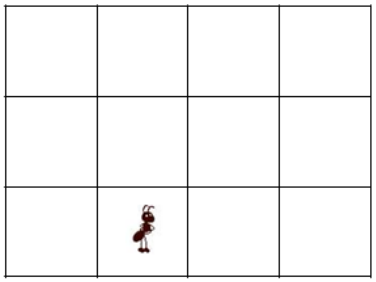
In a doubly linked list, each node contains, besides the next-node link, a second link field pointing to the previous node in the sequence.



A doubly linked list whose nodes contain three fields: an integer value, the link forward to the next node, and the link backward to the previous node

EXPERIMENT

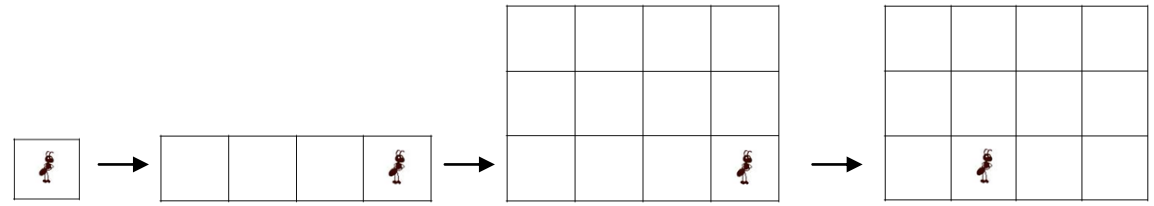
You are going to practice on doubly-linked lists in this experiment and create your own linked list structure in order to develop a simple text-based game. In the game there is going to be an imaginary endless matrix and an *ant* moving on this matrix by the commands of the user.



Each cell in the matrix is a node of the linked list.

The user commands are; *move up*, *move down*, *move right*, *move left*, *track* and *not track*. By the '*move*' commands, the ant is going to move in such directions given with the command, by the '*track*' command, the ant is going to start leaving a trace on the cells it moves, and by the '*not track*' command, it is going to stop leaving traces on the cells. All traces left by ant are permanent. Therefore, if the ant passes over a cell has a trace in not track mode, the trace is not going to be deleted.

At the beginning of the program, there is going to be only one node. As the ant moves, the rectangular matrix will be enlarged to cover all visited cells.



FORMATS OF INPUT/OUTPUT FILES

There are two files for the execution of the program: an input file and an output file. Names of these files are going to be taken as command line arguments during the execution of the program. First command line argument is the input file name, and the second is the output file name. The input file is going to contain user commands. A sample input file is given below:

```
track
move up 8 units
move right 10 units
move down 8 units
move left 10 units
not track
move up 1 unit
move right 3 units
```

After these commands are executed, an output file like this must be created:

```
**********
*        *
*        *
*        *
*        *
*        *
*        *
*  .     *
**********
```

As it is seen, the cells on which the ant leaves a trace are shown with a '*' character. If the last cell on which the ant takes place has not a trace, it is shown with a '.' character. On the other hand, if it is a tracked cell, it is shown with a '*' character like other tracked cells. For other cells just space characters will be written.

NOTES

- You will use online submission system to submit your experiments. https://submit.cs.hacettepe.edu.tr/ (No other submission method such as diskette, CD or email will be accepted.)
- Your submission code file structure must implement this template:
  <student_id>
    <report>
      report.pdf
    <source>
      source.c
- Submission time for deadline is: 17:00.
- Do not submit any file via e-mail related with this assignment.
- **SAVE** all your work until the assignment is graded.
- The assignment must be original, **INDIVIDUAL** work. Duplicate or very similar assignments are both going to be punished. General discussion of the problem is allowed, but **DO NOT SHARE** your design.
- You can ask your questions through course's news group: news://news.cs.hacettepe.edu.tr/dersler.bil235 And you are supposed to be aware of everything discussed in the newsgroup.

REFERENCES

1. http://en.wikipedia.org/wiki/Linked_list