**CSC248 – Fundamentals of Data Structure**

**Academic Session October 2023 – February 2024**

**Lab Assignment 4 – Linked List (UDT)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Outcomes (CO)** | **LO1** | **LO2** | **LO3** |
| CO1 |  |  |  |
| CO2 | √ | √ | √ |
| CO3 |  |  |  |

The list using dynamic storage to store computer’s information for a computer laboratory. Given the respective classes as follows:

|  |
| --- |
| public class Computer  {  private int serialNo; //computer identification private String brand; //brand name private int year //year of buying private double price //buying price    //Normal constructor  //Getter    } public class ListNode{ private Object obj;  private ListNode next;  :  :  }    public class List  {  private ListNode firstNode; //reference to the first node in the list private ListNode lastNode; //reference to the last node in the list private ListNode currNode; //to traversal purpose  :  :  publicList();  public void insertAtFront(Object); public void insertAtBack(Object); public void insertAtAtMiddle(Object); public Object remove(int);  public void searchComputer(int); public int countComputer(double);  } |

# ( M N O S 2 0 2 3 ) 1 | P a g e

1. Write all definition functions for the above operation to do the following tasks:

* 1. To insert a new node (computer’s information) at the front/back/middle of list. The information is given by a parameter. If the information existed in the list, you don’t have to insert the node. (NOTE\*\* Every computer has a unique serial number identification)

* 1. To remove a node from the list based on the serial number of the computer. Computer serial number is given by a parameter.

* 1. To print the output of computer’s information based on the searching index (the serial number). Computer serial number is given by a parameter.

* 1. To count and return the number of computers which exceed a certain amount price. The amount is given by a parameter. This method also will print the output of brand code and year of buying which computers fulfill the above criteria.

1. Write an application program by implementing **a menu selection** to do the following tasks.

* 1. Insert a new node into list. The computer to be inserted can be at the front, at the back and at the middle of the list based on the user selection.

* 1. To delete any node from a list based on serial number of the computer

* 1. To print the output of computer’s information based on the searching index

* 1. To count and return the number of computers which exceed a certain amount price

Computer.java

public class Computer {

    private int serialNo;

    private String brand;

    private int year;

    private double price;

    public Computer(int serialNo, String brand, int year, double price) {

        this.serialNo = serialNo;

        this.brand = brand;

        this.year = year;

        this.price = price;

    }

    public int getSerialNo() {

        return this.serialNo;

    }

    public void setSerialNo(int serialNo) {

        this.serialNo = serialNo;

    }

    public String getBrand() {

        return this.brand;

    }

    public void setBrand(String brand) {

        this.brand = brand;

    }

    public int getYear() {

        return this.year;

    }

    public void setYear(int year) {

        this.year = year;

    }

    public double getPrice() {

        return this.price;

    }

    public void setPrice(double price) {

        this.price = price;

    }

    public String toString() {

        return "Serial number: " + this.serialNo + "\nBrand: " + this.brand + "\nYear: " + this.year + "\nPrice: RM "

                + String.format("%,.2f", this.price) + "\n";

    }

}

List.java

public class List {

    private ListNode firstNode;

    private ListNode lastNode;

    private ListNode currNode;

    public List() {

        this.firstNode = null;

        this.lastNode = null;

        this.currNode = null;

    }

    public ListNode getFirstNode() {

        return this.firstNode;

    }

    public void setFirstNode(ListNode firstNode) {

        this.firstNode = firstNode;

    }

    public ListNode getLastNode() {

        return this.lastNode;

    }

    public void setLastNode(ListNode lastNode) {

        this.lastNode = lastNode;

    }

    public ListNode getCurrNode() {

        return this.currNode;

    }

    public void setCurrNode(ListNode currNode) {

        this.currNode = currNode;

    }

    public void insertAtFront(Object obj) {

        ListNode newNode = new ListNode(obj, this.firstNode);

        this.firstNode = newNode;

        if (this.lastNode == null) {

            this.lastNode = newNode;

        } else {

            this.lastNode.setNext(newNode);

        }

    }

    public void insertAtBack(Object obj) {

        ListNode newNode = new ListNode(obj, null);

        if (this.lastNode == null) {

            this.firstNode = newNode;

            this.lastNode = newNode;

        } else {

            this.lastNode.setNext(newNode);

            this.lastNode = newNode;

        }

    }

    // insert at middle

    public void insertAtMiddle(Object obj) {

        ListNode newNode = new ListNode(obj, null);

        if (this.firstNode == null) {

            this.firstNode = newNode;

            this.lastNode = newNode;

        } else {

            // put the new node at the middle and not based on the serial number

            ListNode curr = this.firstNode;

            int count = 0;

            while (curr != null) {

                count++;

                curr = curr.getNext();

            }

            curr = this.firstNode;

            for (int i = 0; i < (count / 2) - 1; i++) {

                curr = curr.getNext();

            }

            newNode.setNext(curr.getNext());

            curr.setNext(newNode);

            if (newNode.getNext() == null) {

                this.lastNode = newNode;

            }

        }

    }

    public void insertAtIndex(Object obj, int index) {

        ListNode newNode = new ListNode(obj, null);

        if (this.firstNode == null) {

            this.firstNode = newNode;

            this.lastNode = newNode;

        } else {

            ListNode curr = this.firstNode;

            for (int i = 0; i < index - 1; i++) {

                curr = curr.getNext();

            }

            newNode.setNext(curr.getNext());

            curr.setNext(newNode);

            if (newNode.getNext() == null) {

                this.lastNode = newNode;

            }

        }

    }

    public Object remove(int serialNo) {

        ListNode curr = this.firstNode;

        ListNode prev = null;

        while (curr != null) {

            if (((Computer) curr.getObj()).getSerialNo() == serialNo) {

                break;

            }

            prev = curr;

            curr = curr.getNext();

        }

        if (curr == null) {

            return null;

        }

        if (prev == null) {

            this.firstNode = curr.getNext();

        } else {

            prev.setNext(curr.getNext());

        }

        if (curr.getNext() == null) {

            this.lastNode = prev;

        }

        return curr.getObj();

    }

    public void searchComputer(int serialNo) {

        ListNode curr = this.firstNode;

        while (curr != null) {

            if (((Computer) curr.getObj()).getSerialNo() == serialNo) {

                break;

            }

            curr = curr.getNext();

        }

        if (curr == null) {

            System.out.println("Computer not found");

        } else {

            System.out.println(curr.getObj());

        }

    }

    public int countComputer(double price) {

        int count = 0;

        ListNode curr = this.firstNode;

        while (curr != null) {

            if (((Computer) curr.getObj()).getPrice() > price) {

                count++;

                // print out the computer

                System.out.println(curr.getObj() + "\n");

            }

            curr = curr.getNext();

        }

        return count;

    }

    public int getSize() {

        int count = 0;

        ListNode curr = this.firstNode;

        while (curr != null) {

            count++;

            curr = curr.getNext();

        }

        return count;

    }

    public void print() {

        ListNode curr = this.firstNode;

        boolean empty = true;

        while (curr != null) {

            System.out.println(curr.getObj() + "\n");

            curr = curr.getNext();

            empty = false;

        }

        if (empty) {

            System.out.println("List is empty");

        }

    }

}

ListNode.java

public class ListNode {

    private Object obj;

    private ListNode next;

    public ListNode(Object obj, ListNode next) {

        this.obj = obj;

        this.next = next;

    }

    public Object getObj() {

        return this.obj;

    }

    public void setObj(Object obj) {

        this.obj = obj;

    }

    public ListNode getNext() {

        return this.next;

    }

    public void setNext(ListNode next) {

        this.next = next;

    }

    public String toString() {

        return this.obj.toString();

    }

}

Main.java

import java.util.Scanner;

public class Main {

    public static void main(String[] args) {

        Scanner strInput = new Scanner(System.in);

        Scanner intInput = new Scanner(System.in);

        int choice = 0;

        System.out.println("Welcome to Computer List Program\n");

        List list = new List();

        while (choice != 6) {

            System.out.print(

                    "1. Insert a new node into list\n2. Delete node from list based on serial number\n3. Print output of computer's information\n4. Count and return the number of computers which exceed a certain amount price\n5. Display all lists\n6. Exit\n\nEnter your choice: ");

            choice = intInput.nextInt();

            System.out.println();

            if (choice == 1) {

                System.out.print("Enter serial number: ");

                int serialNo = intInput.nextInt();

                // check if theres any computer with the same serial number

                ListNode curr = list.getFirstNode();

                boolean exist = false;

                while (curr != null) {

                    if (((Computer) curr.getObj()).getSerialNo() == serialNo) {

                        System.out.println("Serial number already exist\n");

                        exist = true;

                        break;

                    }

                    curr = curr.getNext();

                }

                if (exist) {

                    continue;

                }

                System.out.print("Enter brand: ");

                String brand = strInput.nextLine();

                System.out.print("Enter year: ");

                int year = intInput.nextInt();

                System.out.print("Enter price (RM): ");

                double price = intInput.nextDouble();

                System.out.print(

                        "\n1. Insert at the beginning of the list\n2. Insert at the end of the list\n3. Insert at middle of the list\n4. Insert node at specific index\n\nEnter your choice: ");

                int choice2 = intInput.nextInt();

                if (choice2 == 1) {

                    list.insertAtFront(new Computer(serialNo, brand, year, price));

                } else if (choice2 == 2) {

                    list.insertAtBack(new Computer(serialNo, brand, year, price));

                } else if (choice2 == 3) {

                    list.insertAtMiddle(new Computer(serialNo, brand, year, price));

                } else if (choice2 == 4) {

                    if (list.getSize() == 0) {

                        System.out.println("List is empty");

                        continue;

                    }

                    System.out.print("Enter index (0 - " + list.getSize() + "): ");

                    int index = intInput.nextInt();

                    if (index < 0 || index > list.getSize()) {

                        System.out.println("Index is not reachable");

                        continue;

                    }

                    list.insertAtIndex(new Computer(serialNo, brand, year, price), index);

                } else {

                    System.out.println("Invalid choice");

                }

            } else if (choice == 2) {

                System.out.print("Enter serial number: ");

                int serialNo = intInput.nextInt();

                if (list.remove(serialNo) == null) {

                    System.out.println("Serial number not found\n");

                } else {

                    System.out.println("Serial number \*" + serialNo + "\* has been deleted\n");

                }

            } else if (choice == 3) {

                System.out.print("Enter serial number: ");

                int serialNo = intInput.nextInt();

                System.out.println();

                list.searchComputer(serialNo);

            } else if (choice == 4) {

                System.out.print("Enter price to print out which computers price exceed it (RM): ");

                double price = intInput.nextDouble();

                System.out.printf("\n\nComputer Information about price exceed RM %,.2f\n\n", price);

                System.out.printf("\n\nThere's %d computers which exceed RM %,.2f\n\n", list.countComputer(price),

                        price);

            } else if (choice == 5) {

                list.print();

            } else {

                System.out.println("Invalid choice");

            }

            System.out.println();

        }

        strInput.close();

        intInput.close();

        System.out.println("Program terminating...");

    }

}

Sample OutputA screenshot of a computer list

Description automatically generatedA screenshot of a computer program

Description automatically generatedA screenshot of a computer program

Description automatically generatedA computer screen shot of a black screen

Description automatically generatedA screenshot of a computer program

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