

Problem Set 2 - Solution

Linked Lists

1. Assuming an **IntNode** class defined like this:

```
public class IntNode {
    public int data;
    public IntNode next;
    public IntNode(int data, IntNode next) {
        this.data = data; this.next = next;
    }
    public String toString() {
        return data + "";
    }
}
```

Implement a method that will add a new integer before a target integer in the list. The method should return a pointer/reference to the front node of the resulting list. If the target is not found, it should return front without doing anything:

```
public static IntNode addBefore(IntNode front, int target, int newItem) {
    /* COMPLETE THIS METHOD */
}
```

SOLUTION

```
public static IntNode addBefore(IntNode front, int target, int newItem) {
    IntNode prev=null, ptr=front;
    while (ptr != null && ptr.data != target) {
        prev = ptr;
        ptr = ptr.next;
    }
    if (ptr == null) { // target not found
        return front;
    }
    IntNode temp = Intnew Node(newItem, ptr); // next of new node should point to target
    if (prev == null) { // target is first item, so new node will be new front
        return temp;
    }
    prev.next = temp;
    return front; // front is unchanged
}
```

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2. With the same **IntNode** class definition as above, implement a method that will add a new integer before the last item in a linked list. (In other words, the added integer will become the second-to-last item in the resulting linked list.) The method should return a pointer/reference to the front node of the resulting linked list. If the input linked list is empty, the method should return null, without doing anything.

```
public static IntNode addBeforeLast(IntNode front, int item) {
    /* COMPLETE THIS METHOD */
}
```

SOLUTION

```

public static IntNode addBeforeLast(IntNode front, int item) {
    if (front == null) {
        return null;
    }
    IntNode prev=null, ptr=front;
    while (ptr.next != null) {
        prev = ptr;
        ptr = ptr.next;
    }

    IntNode temp = Intnew Node(item, ptr); // next of new node should point to last
    if (prev == null) { // added item is first, so new node will be new front
        return temp;
    }
    prev.next = temp;
    return front; // front is unchanged
}

```

3. Given the following definition of a `StringNode` class:

```

public class StringNode {
    public String data;
    public StringNode next;
    public StringNode(String data, StringNode next) {
        this.data = data; this.next = next;
    }
    public String toString() {
        return data;
    }
}

```

Implement a method that will search a given linked list for a target string, and return the number of occurrences of the target:

```

public static int numberOfOccurrences(StringNode front, String target) {
    /* COMPLETE THIS METHOD */
}

```

SOLUTION

```

public static int numberOfOccurrences(StringNode front, String target) {
    int count=0;
    for (StringNode ptr=front;ptr != null;ptr=ptr->next) {
        if (target.equals(ptr.data)) {
            count++;
        }
    }
    return count;
}

```

4. * Assuming the `IntNode` class definition of problem 1, implement a method to delete EVERY OTHER item from an integer linked list. For example:

```

before: 3->9->12->15->21
after: 3->12->21

```

```

before: 3->9->12->15
after: 3->12

```

before: 3->9
after: 3

before: 3
after: 3

If the list is empty, the method should do nothing.

```
public static void deleteEveryOther(IntNode front) {  
    /* COMPLETE THIS METHOD */  
}
```

SOLUTION

```
public static void deleteEveryOther(IntNode front) {  
    if (front == null) {  
        return;  
    }  
    Node prev=front, ptr=front.next;  
    boolean tbd=true;  
    while (ptr != null) {  
        if (tbd) {  
            ptr = ptr.next;    // advance to after item to be deleted  
            prev.next = ptr;    // bypass item to be deleted  
            tbd = false;       // next item should not be deleted  
        } else {  
            prev = ptr;        // don't delete this (ptr) item, advance prev and ptr  
            ptr = ptr.next;  
            tbd = true;        // but mark next item for deletion  
        }  
    }  
}
```

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5. * With the same [StringNode](#) definition as in the previous problem, implement a method that will delete all occurrences of a given target string from a linked list, and return a pointer to the first node of the resulting linked list:

```
public static StringNode deleteAllOccurrences(StringNode front, String target) {  
    /* COMPLETE THIS METHOD */  
}
```

SOLUTION

```
public static StringNode deleteAllOccurrences(StringNode front, String target) {  
  
    if (front == null) {  
        return null;  
    }  
  
    StringNode curr=front, prev=null;  
  
    while (curr != null) {  
        if (curr.data.equals(target)) {  
            if (prev == null) {    // target is the first element  
                front = curr.next;  
            } else {  
                prev.next = curr.next;  
            }  
        } else {  
            prev = curr;  
        }  
    }  
}
```

```

    }
    curr = curr.next;
}

return front;
}

```

6. * Implement a (NON-RECURSIVE) method to find the common elements in two **sorted** linked lists, and return the common elements in **sorted** order in a NEW linked list. The original linked lists **should not** be modified. So, for instance,

```

l1 = 3->9->12->15->21
l2 = 2->3->6->12->19

```

should produce a new linked list:

```

3->12

```

You may assume that the original lists do not have any duplicate items.

Assuming an **IntNode** class defined like this:

```

public class IntNode {
    public int data;
    public IntNode next;
    public IntNode(int data, IntNode next) {
        this.data = data; this.next = next;
    }
    public String toString() {
        return data + "";
    }
}

```

Complete the following method:

```

// creates a new linked list consisting of the items common to the input lists
// returns the front of this new linked list, null if there are no common items
public IntNode commonElements(IntNode frontL1, IntNode frontL2) {
    ...
}

```

SOLUTION

```

public IntNode commonElements(IntNode frontL1, IntNode frontL2) {
    IntNode first=null, last=null;
    while (frontL1 != null && frontL2 != null) {
        if (frontL1.data < frontL2.data) {
            frontL1 = frontL1.next;
        } else if (frontL1.data > frontL2.data) {
            frontL2 = frontL2.next;
        } else {
            IntNode ptr = new IntNode(frontL1.data, null);
            if (last != null) {
                last.next = ptr;
            } else {
                first = ptr;
            }
            last = ptr;
            frontL1 = frontL1.next;
            frontL2 = frontL2.next;
        }
    }
}

```

```
    return first;  
}
```
