Cosc 241
Programming and Problem Solving
Lecture 10 (26/3/2020)
More links

Michael Albert
michael.albert@cs.otago.ac.nz

Keywords: doubly linked list

UNIVERSITY of OTAGO
SAPERE AUDE
Te Whare Wānanga o Otāgo
NEW ZEALAND

Linked lists again

- In a mental image of a linked list each item (except the last) has one that follows it, and each item (except the first) has one that precedes it.
- In a singly linked list, we can access the next item directly (via its reference), so in $O(1)$ time from a given node.
- To find the preceding item we need to sneak up on it via a list traversal, so in $O(n)$ time, where n is the size of the list.
- In a doubly linked list, we aim to make both operations $O(1)$ by keeping a second reference.
- Since a doubly linked list is really just two intertwined singly linked lists, we should be able to reuse and modify much of our existing code.

Modifying the SLL code

- Start with a copy of the source file.
- Go through method by method, changing names, and updating for new references.
- Start with the node class since that's where all the "action" happens.
- Try to compile.
- Use the error messages to spot the names you've forgotten to change.
- Rinse and repeat.

Lessons learned

- Getting doubly linked lists working correctly is a bit tricky.
- It's a very good thing not to allow the outside world direct access to, or modification of, the links.
- Changes can't just be made locally – if we are modifying the `prev` reference of one node, then the `next` reference of the node it points to must also be changed for consistency (and vice versa).
- Frankly, most of the time, it's not really worth it.
- Can you think of an example where a (functional equivalent of a) DLL is commonly used? [There are at least two]

Just for fun

- Imagine processing an incoming stream of items, adding them to a list.
- We want to maintain this list in sorted order at all times.
- We suspect that the items have been partially sorted already, and in particular that it's likely that successive items are likely to finish up close together.
- Using a DLL with a current pointer seems like a cute solution – each additional item starts looking where the last one was added to find its place.
- Time to code.