CSC 212: Data Structures and Abstractions
12: Linked Lists (part 2)

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THINK BIG WE DO™

Recursion

‣ Definition

✓ method of solving problems that involves <u>breaking a problem into smaller and smaller subproblems</u> (of the same structure) until reaching a <u>small enough problem</u> that can be solved trivially

‣ Recursive functions

✓ technically, a recursive function is one that invokes itself

✓ must contain at least one base case and one recursive call

✓ **base case**: a terminating condition that halts the recursion

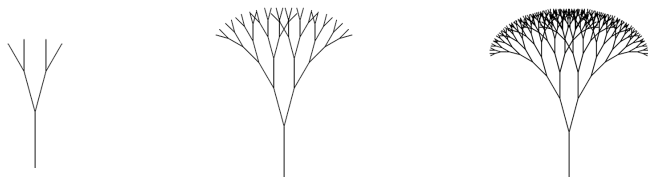✓ **recursive case**: a condition that perpetuates the recursion by calling the function again

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Why recursion?

‣ Can we live without it?

✓ yes, every recursive function has an equivalent iterative solution

‣ However …

✓ some formulas are inherently recursive in nature

✓ some problems naturally lend themselves to recursive solutions

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Practice

‣ Write a recursive function to add all elements in a vector

✓ trace the call sequence, including the parameters passed at each step

```cpp
int sum_array(std::vector<int>& A, int n) {
    // base case
    if (n == 1) {
        return A[0];
    }

    // recursive call
    int partial_sum = sum_array(A, n-1);

    // return sum
    return A[n-1] + partial_sum;
}
```

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SLL Methods (recursive implementation)

‣ clear()
  ✓ traverse the list and deletes each node
  ✓ resets head and tail to nullptr and size to zero

‣ print()
  ✓ uses a temporary pointer to traverse the list starting from the head
  ✓ prints the value stored in each node during traversal

‣ search(value)
  ✓ uses a temporary pointer to traverse the list starting from the head
  ✓ compares each node's value with the target value
  ✓ returns true if the value is found; otherwise, returns false

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Methods (recursive implementation)

‣ at(index)
  ✓ returns the element at the specified index (starting from 0)

‣ reverse()
  ✓ traverses the list and reverses the direction of all node pointers
  ✓ swaps the head and tail pointers

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