

# CS010C

Lab4

# Review: C++ class

- If you are using std functions, types, ...
  - Put `using namespace std;` at the top
  - Or add `std::` every time you use them
- If you want to access a private variable from outside
  - Write an public `accessor`
  - Or `temporarily` change it to `public(just for Lab2 demo)`
- How to call a public member function from outside?
  - A `Pointer` of object
    - use `->` (right arrow)
  - A `Class object` or a `reference` to a class object, etc.
    - use `.(dot)`

# Lab2 demo: rule of 3

- Destructor `~`
  - New dummy head & tail(not nullptr!)
  - Set their pointers
- Copy constructor `()`
  - New dummy head & tail
  - For each node in “that”(or say “rhs”) list, “push back” its value to “this” list
- Copy assignment operator `=`
  - Delete the nodes of “this”(or say “lhs”) list
  - Then similar to copy constructor

Check 3 cases

- Checkbox 

~	()	=
---	----	---
- Destructor
- Copy constructor
- Copy assignment operator

```
Deleting node with value: 20 at address: 0x228df10
Deleting node with value: 10 at address: 0x228def0
Near the end of main, before deleting
free(): double free detected in tcache 2
run.sh: line 1: 186468 Aborted (core dumped) ./a.out
```

```
list1 : 0x7fffaf6af110
Dummy Head | address: 0x9f2eb0
value: 20 | address: 0x9f2f10
value: 10 | address: 0x9f2ef0
Dummy Tail | address: 0x9f2ed0

Testing = operator
list2 : 0x7fffaf6af100
Dummy Head | address: 0x9f2eb0
value: 20 | address: 0x9f2f10
value: 10 | address: 0x9f2ef0
Dummy Tail | address: 0x9f2ed0

Testing copy constructor
list3 : 0x7fffaf6af0f0
Dummy Head | address: 0x9f2eb0
value: 20 | address: 0x9f2f10
value: 10 | address: 0x9f2ef0
Dummy Tail | address: 0x9f2ed0

Testing = at initialization
list4 : 0x7fffaf6af0e0
Dummy Head | address: 0x9f2eb0
value: 20 | address: 0x9f2f10
value: 10 | address: 0x9f2ef0
Dummy Tail | address: 0x9f2ed0

list5 : 0x9f3380
Dummy Head | address: 0x9f2eb0
value: 20 | address: 0x9f2f10
value: 10 | address: 0x9f2ef0
Dummy Tail | address: 0x9f2ed0
```

```
list1 : 0x7ffe27df0500
Dummy Head | address: 0x1b1aeb0
value: 20 | address: 0x1b1af10
value: 10 | address: 0x1b1aef0
Dummy Tail | address: 0x1b1aed0

Testing = operator
list2 : 0x7ffe27df04f0
Dummy Head | address: 0x1b1b340
value: 20 | address: 0x1b1b380
value: 10 | address: 0x1b1b360
Dummy Tail | address: 0x1b1b3e0

Testing copy constructor
list3 : 0x7ffe27df04e0
Dummy Head | address: 0x1b1b3c0
value: 20 | address: 0x1b1b420
value: 10 | address: 0x1b1b400
Dummy Tail | address: 0x1b1b3e0

Testing = at initialization
list4 : 0x7ffe27df04d0
Dummy Head | address: 0x1b1b440
value: 20 | address: 0x1b1b4a0
value: 10 | address: 0x1b1b480
Dummy Tail | address: 0x1b1b460

list5 : 0x1b1b4c0
Dummy Head | address: 0x1b1b4e0
value: 20 | address: 0x1b1b540
value: 10 | address: 0x1b1b520
Dummy Tail | address: 0x1b1b500
```

Program2

# stack

- Typedef: **typedef int T;**
  - Give **int** a new name **T**
  - Actually replace **T** with **int**

Answer:

```
// typedef int T;  
  
template <class T>
```

- Concrete/Regular Function
  - “**CertainType1** FunctionName(**CertainType2** parameter1, ...)”
  - a **fixed** return type and fixed parameter types

```
int main(int argc, char const *argv[])
```

- Template Function
  - Return and parameter types are **not fixed**
    - Generate concrete functions for various specific types on demand
  - Multiple template types can be used for the parameters and return value

```
template <typename T, typename U>  
T convertTo(U value)  
{  
    return static_cast<T>(value);  
}
```

# RPN(Postfix2Num)

- I/O hint
  - fstream

```
std::string input = argv[1];  
std::ifstream file(input);
```

- **negative** numbers

- The first character is a '-'
- Not a single '-' (It is the minus symbol)

```
77 -6 + 2 / 10 5 3
```

```
token[0] == '-'
```

```
token.size() > 1
```

- Idea: use a stack(algorithm available on zybooks)
  - Encounter a number
    - push
  - Encounter a symbol
    - Pop out 2 numbers from stack and perform the operation
    - Get an operation result. How should we handle it?

```
8 5 - 4 * 3 - 3 / 2 * 4 * 16 * 512 -
```

# Infix2Postfix

$((((12 * (5 + 6))) - (8 * (5 - 3))) / ((4 - 2) * 2)) - (8 + 12)$

- I/O hint
  - Fstream: `file >> token;`
  - Works great for the most part, except for
    - '(' & ')'
  - Print the token you parse each time, to see if they were read correctly!

- Algorithm(see zybooks)

- Precedence(low, '+' or '-')
  - Output & Pop until?
- Parenthesis(right, ')')
  - Output & Pop until a left parenthesis is encountered

12 \* 5 + 6 + 8 \* 7  
          ↑      ↑  
          high  low

(12 \* (5 - 7) - 8 \* (7 - 1)) / ((4 - 2) \* 16)

```
Algorithm Infix-to-Postfix(infix_expression P)
// input: infix expression
// output: postfix expression

create an empty stack S to hold chars
size = P.size()
i <- 0

for each p[i] in P // where i = {0, 1, ..., P.size()-1}
  if p[i] is a operand
    output p[i]
  if p[i] is an operator: *, /, +, -
    output S.top() and S.pop() from S until left paren at S->top OR
    S.top() holds operator with lower precedence than p[i]
    S.push( p[i] )
  if p[i] == '('
    S.push( p[i] )
  if p[i] == ')'
    // right paren causes stack to empty up to and including left paren
    S.top() and S.pop() to output from S until '(' found
    S.top() and S.pop() '(' to output
  while ( !S.empty )
    output S.top() // this is result
    S.pop()
NOTE: Parentheses are not written to the output
```