Problem Solving

DM2111
C++ Programming

Introduction

Introduction	Array and Strings
Problem solving	Array and Strings
Basic elements of C++	Pointers
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Logic and branching	I/O operations
Repetition	Structs
Functions	Others
Functions	

Agenda

- Problem Analysis
- Pseudo-Coding
- Flowcharting

Problem Analysis

- Programming is a process of problem solving
- Thoroughly understand the problem
  - User interaction
  - Data manipulation
  - Input / Output
- Subdivide a complex problem into subproblems
  - Analyse each subproblem as above
- Design algorithms for each problem
- Check correctness of algorithm
  - Test data
  - Mathematical analysis

Problem Analysis

Trivial problem:

Find the sum of numbers from 1 to n

Problem Analysis

answer = 1 + 2 + 3 + 4 + … + n-1 + n

Can we do better?

Problem Analysis

sum of arithmetic progression = arithmetic series

$$S_n = \frac{n}{2}(1 + n)$$

Can we do better?

Problem Analysis

Suppose we want to put the values in a lookup table

n	1	2	3	4	5	6	7	8	9	10
sum	1	3	6	10	15	21	28	36	45	55

$$S_n = \frac{n}{2}(1+n)$$

Can we do better?

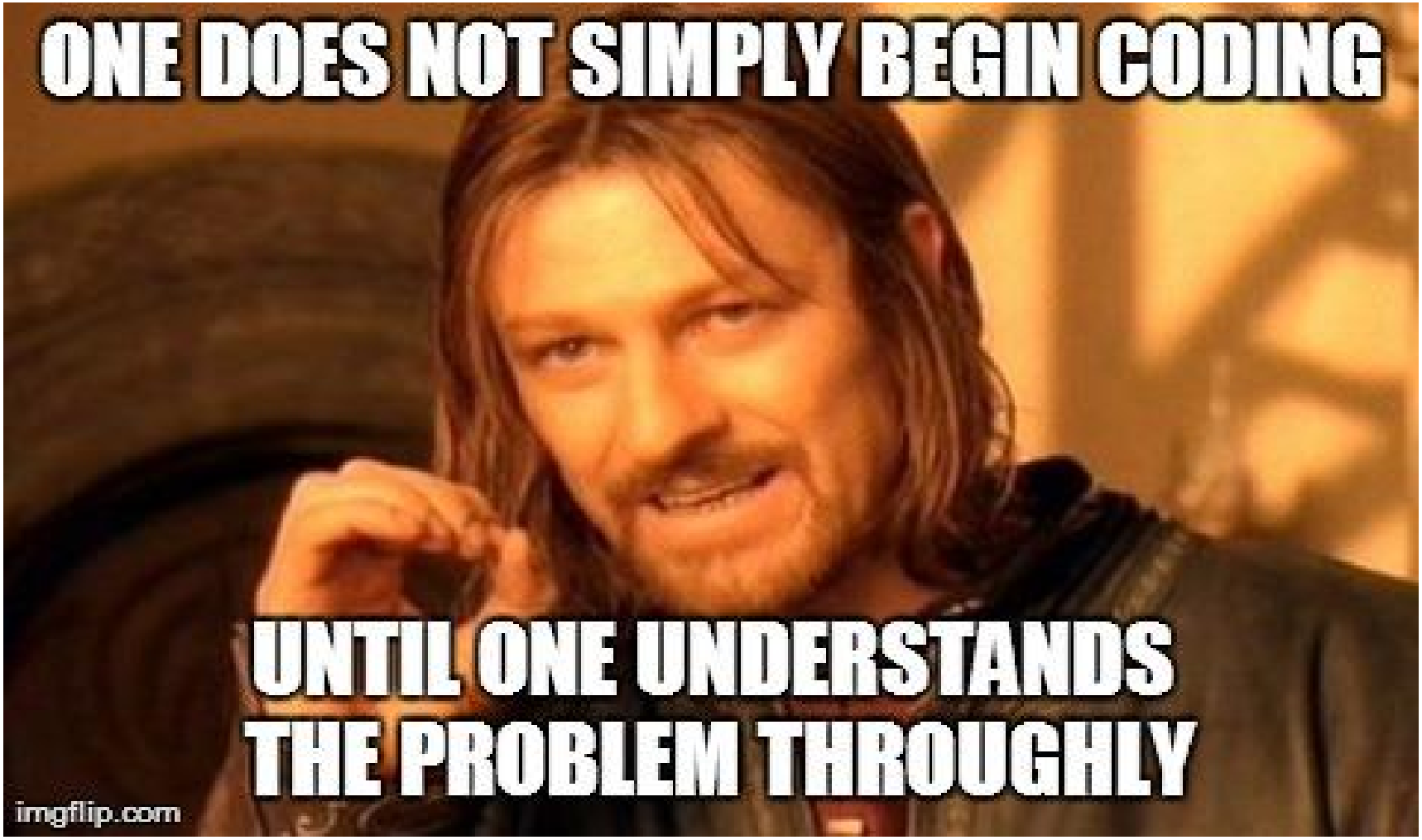
Problem Analysis

Suppose we want to put the values in a lookup table

n	1	2	3	4	5	6	7	8	9	10
sum	1	3	6	10	15	21	28	36	45	55

$$S_n = S_{n-1} + n$$

Can we do better?


ONE DOES NOT SIMPLY BEGIN CODING
UNTIL ONE UNDERSTANDS
THE PROBLEM THROUGHLY
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Pseudo-Coding

- To print the sum of 2 values provided by user
  - Get 2 values from user
  - Add the 2 values
  - Print result of addition

Pseudo-Coding

- To print the sum of 2 values provided by user
  - Get 2 values from user
    - Get first value from user and store
    - Get second value from user and store
  - Add the 2 values
    - Add the 2 values and store
  - Print result of addition

Pseudo-Coding

1. Get first value from user and store
2. Get second value from user and store
3. Add the 2 values and store
4. Print result of addition

```
1.  cin >> val1
2.  cin >> val2
3.  result = val1 + val2
4.  cout << result
```

Pseudo-Coding

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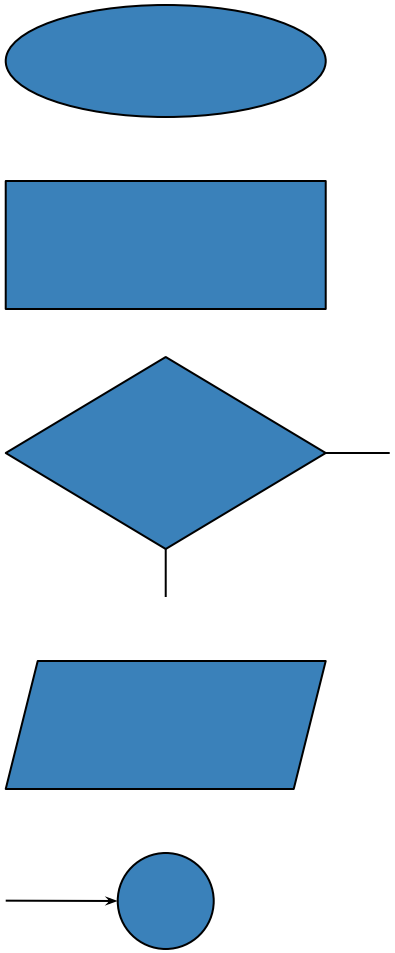
```
#include <iostream>

using namespace std;

void main (void) {
    int val1, val2,
   result;

    cin >> val1;
    cin >> val2;

    result = val1 + val2;

    cout << result;
}
```

Flowcharting

- Represents problem solving in a diagrammatic form



Start / End

Process

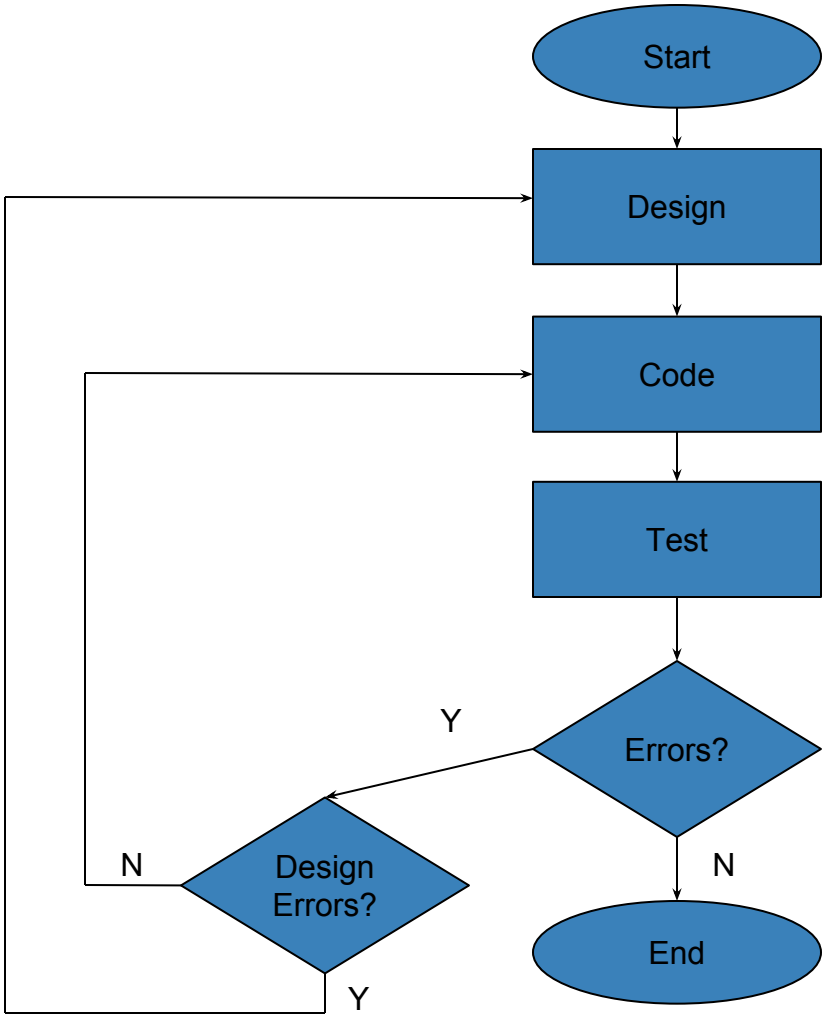
Decision

Input / Output

Connector

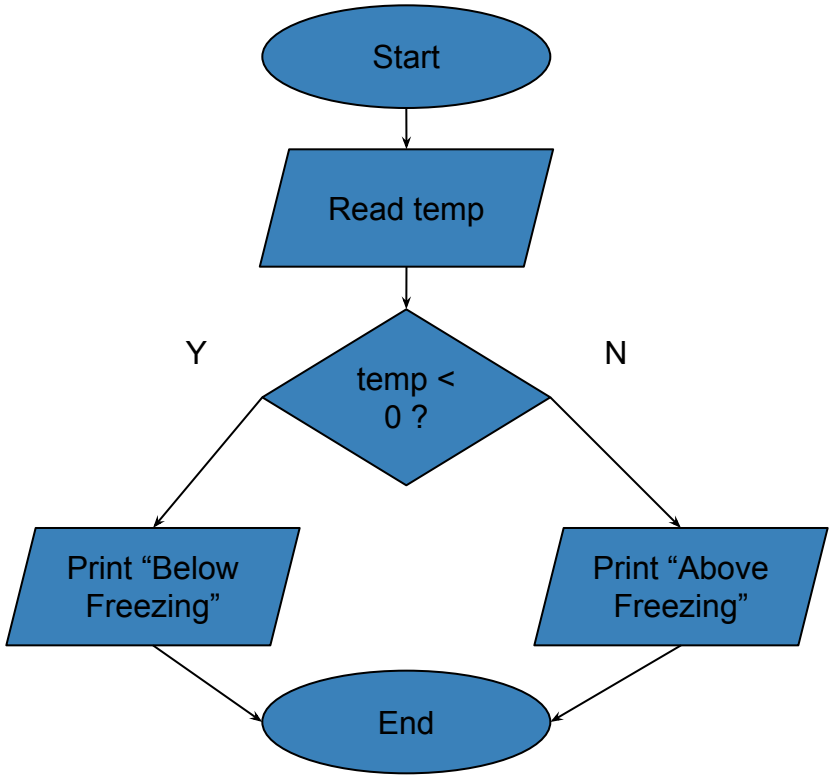
Flowcharting

- Example 1



Flowcharting

- Example 2
  - Get temp from user
  - If temp < 0 print “Below Freezing”
  - Otherwise print “Above Freezing”



Flowcharting

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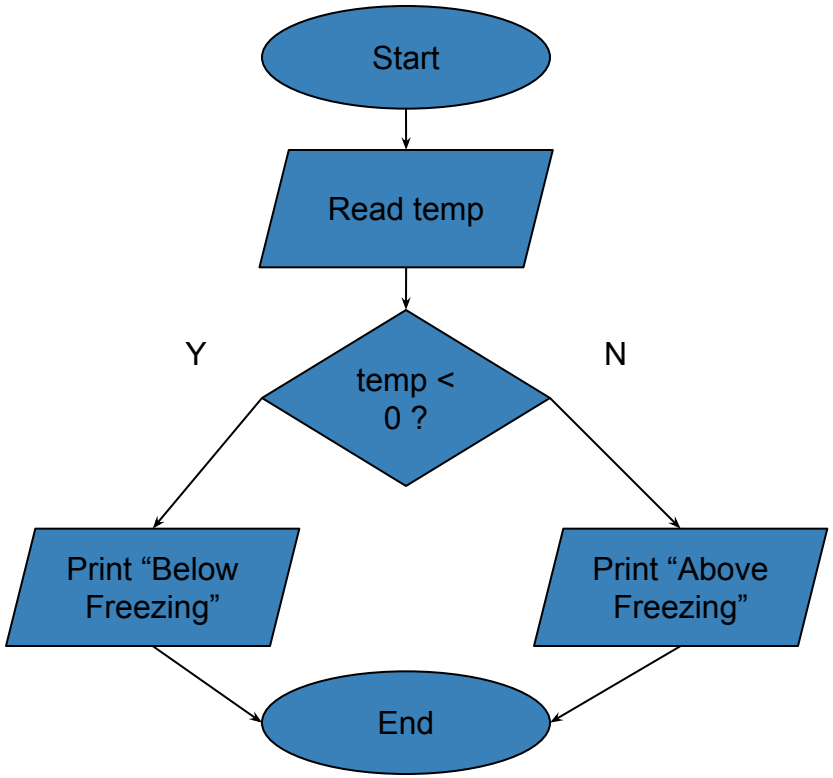


```
#include <iostream>

using namespace std;

void main (void) {
     int temp;

     cin >> temp;

     if (temp < 0)
          cout << ”Below Freezing”;
     else
          cout << ”Above Freezing”;
}
```