In-class Worksheet #3
Fall 2022 , Oct 7, 2022
Computer Science I & Lab

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Programming:

1. Analyzing problem/requirement
2. **Breaking it down to steps**
3. Express your idea (step-by-step approach to solve the problem) in C++ code
   ==> Require your understanding of C++ language,
   ==> e.g., how to declare a variable? How to do computations… How to branch?
     How to repeat? …
4. Compile your code and fix any compilation errors (or syntax) errors.
5. Run your executable, and try different inputs and check if the program generates the expected (correct) output
   Chances are there are mistakes (bugs) in your code, and you need to fix them (debug).
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1. Practice code tracing

   Code Tracing is about carrying out a program's execution on paper. This is an essential skill for debugging, and for understanding a piece of code's behavior.

   Here are basic pointers for code tracing:

- Keep track of all variables: using a box labelled with the variable name to represent each variable, and write the variable's value inside the box
- Draw an arrow next to the current statement
- Keep track of output of the program in a separate area

Practice #1

What output will be produced by the following code, when embedded in a complete program? What will be the output if firstChoice is initialized to 3, 2, or 4?

```cpp
int firstChoice=1;

switch (firstChoice +1)
{
    case 1:
        cout <<"Roast beef\n";
        break;
```

```cpp
        case 2:
            cout <<"Roast worm\n";
            break;
        case 3:
            cout <<"Chocolate ice cream\n";
        case 4:
            cout <<"Onion ice cream\n";
            break;
        default:
            cout <<"Bon appetit!\n";
    }
```

Practice 2:

What's the output of the the following code?

```cpp
int x=10;
while (x>0)
{
    cout <<x<<endl;
    x-=3;
}
```

Practice 3:

What's the output of the following code?

```cpp
Int x=-42;
do {
    cout <<x<<endl;
    x -= 3;
} while (x>0);
```

Practice 4:

What's the output of the following code if the user types 4 at the prompt? Is there any logic error based upon the comment?

```cpp
Int x;
cout<<"enter an integer:";
cin>>x;
int sum=0;

//calculate sum of 1,2,.. x
```

```
for (int i=0; i<x; i++)
{
    sum += x;
}
```

2. Pseudocode, stepwise refinement of ideas

When solving a problem, do not start to code right away. Instead write down your idea in English or pseudocode, and keep refining it by adding more and more details.

Example: Write a code segment to read 100 integers from input, and calculate the sum of all these numbers.

Idea v1:

1. Read 100 numbers
2. Add them up

Q1. How to read 100 numbers?

Q2. How to store these numbers?

Idea v2:

1. Repeat for 100 times:
   a. Read in a number into a int type variable

2. Add these numbers up

Q3: How many int type variable to use?

Ideas v3:

1. Repeat for 100 times:
   a. Read in a number into a int type variable
2. Add the variable into the "running total"

Q4: How to keep track of running total?

Use another variable

Ideas v4:

1. Initialize running total to 0
2. Repeat for 100 times:
    a. Read in a number into an int type variable
    b. Add the variable into the running total
3. Display the running total

Practice:

1. Modify Idea v4 if the problem is changed to:

Read 100 numbers from input, and calculate the sum of all positive numbers, and the sum of all negative numbers

2. Write C++ code to solve the above problem based upon your pseudocode.

Example:

How to read integer values from input until a -1 is entered, and then calculate the sum and average of these numbers?

Note: Use the same idea as the previous example, to use each number to update the sum right after it's read, this way, we don't need to store all numbers in variable.

Pease write down at least two versions of your idea to this problem.

Game of 23 Ideas

V1:

Keep playing the game until someone (human or computer loses)

V2:

1. Start with 23 toothpicks
2. Repeat until someone loses
     1) Human/computer takes turn to remove toothpicks
     2) If toothpicks left is 0, then this player loses

Q1: How to keep track of game status?

Q2: How to make the two players take turn?

V3: With answers to Q1 and Q2, we refine our ideas as follows:

(Now think about how human makes a move, and how computer makes its move)