Week 4: In-Class Exercises

Please download the resource from *http://blue.smu.edu.sg/cs101/ice4-resource.zip*

1. **[Difficulty: *]** Write a program to prompt the user for a number, n where 0 < n < 2147483647(MAX_INT). Then calculate and print the sum of all multiples of 7 from 1 to n. Use a `long` data type for your accumulation.

```
Enter n:1000
71071
```

2. **[Difficulty: *]** Write a program that continuously takes integers as input, and displays the smallest and largest integers input so far. The program ends when a negative number is input.

```
Enter number: 4
Largest so far == 4. Smallest so far == 4.
Enter number: 2
Largest so far == 4. Smallest so far == 2.
Enter number: 7
Largest so far == 7. Smallest so far == 3.
Enter number: 5
Largest so far == 7. Smallest so far == 3.
Enter number: -1
Bye!
```

3. **[Difficulty: **]** Write a program that prompts the user for two numbers. Call them n1 and n2. Keep prompting the user until the sum of n1 and n2 is divisible by 3. Then display all numbers between n1(inclusive) and n2 (inclusive) in increasing order. Note that n1 may be smaller than n2, equal to n2, or greater than n2. You need to handle all scenarios. You are free to choose any loop construct together with any if/else construct for this question.

```
cwarrior:/mnt/c/cs101/ice4$./a.out
Enter n1>3
Enter n2>4
Invalid!

Enter n1>3
Enter n2>6
3 4 5 6

cwarrior:/mnt/c/cs101/ice4$./a.out
Enter n1>6
Enter n2>3
3 4 5 6
```

4. Write a program that takes as input a positive integer, and displays the number of digits in that integer. Use **ONLY** concepts covered so far.

```
cwarrior:/mnt/c/cs101/ice4$./a.out
Enter num:0
0

cwarrior:/mnt/c/cs101/ice4$./a.out
Enter num:6
1

cwarrior:/mnt/c/cs101/ice4$./a.out
Enter num:123
3

cwarrior:/mnt/c/cs101/ice4$./a.out
Enter num:1256704
7
```

5. Consider a looping program which takes one character c as input, and displays vowel or consonant depending on whether c is a vowel('a', 'e', 'i', 'o', 'u') or consonant (the rest of the letters). The program terminates when a non-letter is read.
    a. Write the program using a switch statement.
    b. Write the program using an if statement.

```
Enter letter:s
consonant

Enter letter:A
vowel

Enter letter:a
vowel

Enter letter:#
Bye bye
```

6. **[Difficulty: **]** Write a looping program which takes integers as input, and displays whether each integer is a palindrome or not. The program terminates when -1 is read.

```
Enter integer:123456
123456 is not a palindrome.

Enter integer:12321
12321 is a palindrome.

Enter integer:1
1 is a palindrome.

Enter integer:123
123 is not a palindrome.

Enter integer:454
454 is a palindrome.

Enter integer:-1
Bye bye!
```

OPTIONAL

7. Write a program that prompts for 2 numbers, and then use loops to calculate and display a list of all prime numbers between the 2 numbers. You can assume the user will enter a start number less than end.

```
Enter start:2
Enter end:100
2 3 5 7 11 13 17 19 23 29 31 37 41 43 47 53 59 61 67 71 73 79 83 89 97
```

8. [**Difficulty: **]** Write a program that simulates Random Number Guessing Game. The program should pick a random number between 1 and 100 (both inclusive) and prompt the user to guess the number until he guesses correctly. If the user's guess is higher than the random number generated, the program should display “High! Try again. If the user's guess is lower than the random number generated, the program should display “Low! Try again.

   If the user guesses correctly, display the count of number of guesses the user took to get it correct and restart the game if the user wishes to do so by entering **Y** at the prompt “Do you want to play again?”

```
cwarrior:/mnt/c/cs101/ice4$./a.out
Enter your guess(1 to 100) :26
Low! Try again

Enter your guess(1 to 100) :46
Low! Try again

Enter your guess(1 to 100) :65
High! Try again

Enter your guess(1 to 100) :59
Low! Try again

Enter your guess(1 to 100) :61
Congrats!

You guessed in 5 attempts

Do you want to play again(Y/y/N/n)?N

Bye!

cwarrior:/mnt/c/cs101/ice4$./a.out
Enter your guess(1 to 100) :26
Low! Try again

Enter your guess(1 to 100) :56
High! Try again

Enter your guess(1 to 100) :35
Congrats!

You guessed in 3 attempts

Do you want to play again? Y

Enter your guess(1 to 100) :55
… #rest of code not shown for brevity
```

9. [**Difficulty: **]** Counting in binary is similar to counting in any other number system. Beginning with a single digit, counting proceeds through each symbol, in increasing order. Decimal (or base-10) counting uses the symbols **0** through **9**, while binary only uses the symbols **0** and **1.** Read more about how a decimal number can be converted to its binary equivalent:
    - http://www.is.wayne.edu/olmt/binary/page3.htm
    - http://www.wikihow.com/Convert-from-Decimal-to-Binary

    Let us see the method to convert decimal number 32(base 10) to its binary equivalent.

    32 divided by 2 gives 16 and remainder **0**
    16 divided by 2 gives 8 and remainder **0**
    8 divided by 2 gives 4 and remainder **0**
    4 divided by 2 gives 2 and remainder **0**
    2 divided by 2 gives 1 and remainder **0**
    1 divided by 2 gives 0 and remainder **1**

    Do you notice that you are dividing the given decimal number by 2 and subsequently in every iteration, the quotient is divided by 2? The binary number is the sequence of remainders in reverse, from the bottom remainder to the top remainder.

    Write a program that converts a positive integer number to its binary equivalent following the procedure explained above. You can check if your conversion is correct using the built-in function.

```
cwarrior:/mnt/c/cs101/ice4$./a.out
Enter num:10
1010

cwarrior:/mnt/c/cs101/ice4$./a.out
Enter num:32
100000
```

10. [**Difficulty: **]** Write a program to print the song "The 12 days of Christmas". Use one switch statement to print the day (i.e. "first", "second" etc). A separate **fall-through switch** should be used to print the remainder of each verse.
    Reference: https://en.wikipedia.org/wiki/The_Twelve_Days_of_Christmas_(song)

11. [**Difficulty: **]** This question introduces you to the break and continue keywords. When dealing with loops, you can use the break and continue keywords to get out of the loop. Read about how to use these keywords in statements within a loop block. It's important to know the difference between these 2 keywords. This may help: https://cs-fundamentals.com/tech-interview/c/difference-between-break-and-continue-in-c-language

    (a) Consider the following code:

```
01  #include <stdio.h>
02
03  int main(void) {
04      for (int i = 0; i < 3; i++) {
05          puts("A");
06          for (int j = 0; j < 3; j++) {
07              puts("B");
08              if (i == 1 || j == 1) { //breaks the loop when i or j = 1
09                  break;
10              }
11              printf("i: %d, j: %d\n", i, j);
12          }
13          puts("C");
14      }
15  }
```

    Trace through the code manually and determine what will be printed out. Then compile and execute it to check if the output matches your expected one.

    (b) Change line 9 to

```
continue;
```

    Trace through the code to predict the output again.