Lesson 7
For loops

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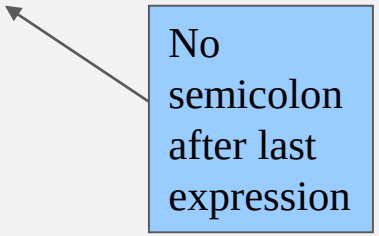
Topic of this week

- Loops
  - Class Lecture Review
    + The for Repetition Structure
    + Notes and Observations
  - Programming Exercises

The for Repetition Structure

- Format when using **`for`** loops

```
for ( initialization ; loopContinuationTest ; increment )
  statement
```



Example:

```
for( int counter = 1; counter <= 10; counter++ )

     printf( "%d\n", counter );
```

– Prints the integers from one to ten.

The for Repetition Structure (II)

- Initialization and increment
  - Can be comma-separated lists

```
for (int i = 0, j = 0;  j + i <= 10; j++, i++)
    printf( "%d\n", j + i );
```

The For Structure: Notes and Observations

- Arithmetic expressions
  - Initialization, loop-continuation, and increment can contain arithmetic expressions. If **`x = 2`** and **`y = 10`**

```
for ( j = x; j <= 4 * x * y; j += y / x )
```

is equivalent to

```
for ( j = 2; j <= 80; j += 5 )
```

- "Increment" may be negative (decrement)
- If loop continuation condition initially **`false`**
  - Body of **`for`** structure not performed
  - Control proceeds with statement after **`for`** structure

Example

```
for (i=1;i<=100;i++) {
   x += i;
   if ((x % i) == 0) { i--; }
}
```

```
for (i=0, j=strlen(s)-1; i<j; i++,j--)
  { c = s[i], s[i] = s[j], s[j] = c; }
```

```
char c;
int count;
for (count=0; (c=getchar() != '.'); count++)
  { }
printf("Number of characters is %d\n", count);
```

Exercise 7.1

- Write a program that prints ten integers and their squares.

```
1   1
2   4
3   9
...
10 100
```

Exercise 7.2

- Write a program that prints out a triangle like:

```
*
**
***
****
*****
******
*******
********
*********
**********
```

Exercise 7.3

- Write a program that lists numbers which is greater than 27 from 1 to 100.
- Write a program that lists odd numbers which is greater than 27 from 1 to 100.

Exercise 7.4

- Write a program that lists prime numbers which is smaller than 100.
- Use math.h library to use some mathematical functions: sqrt,...

Exercise 7.4.1

- Modify the program you have developed for the exercise 7.4 so that:
  - It ask the user to input the number n until the -1 is entered
  - List all prime number from 1 to n

Exercise 7.5

- Alter the exercise 7.4 above by eliminating the even numbers to avoid calling sqrt function many times.

Exercise 7.6

- Try the following program in your compiler.

```
/* Counting down to blast-off */
#include <stdio.h>

int main(void)
{
    int time, start;

    printf("Enter starting time: ");
    scanf("%d", &start);
    printf("\nBegin countdown\n");

    for (time = start; time > 0; time = time - 1)
    {
        printf("T - %d\n", time);
    }

    printf("Blast-off!\n");
    return (0);
}
```

Exercise 7.7

- Write a program that display a table which converts temperatures from Celsius to Fahrenheit.
- Notice the conditions of the loops continuation and the way in which #define macros are used to set constant values.
- fahrenheit = 1.8 * celsius + 32.0;

Exercise 7.8

- Sometimes we need to have loops within loops, this is called nested loops. This program demonstrates how this works. By running it you should see in what sequence the code is called.

exercise7_8.c

```
#include <stdio.h>

int main(void)
{
    int i, j;           /* loop control variables */
    printf("I   J\n"); /* prints column labels */

    for  (i = 1;  i < 4;  i = i + 1) /* outer for loop */
    {
        printf("Outer %6d\n", i);
        for  (j = 0;  j < i;  j = j + 1) /* inner loop */
        {
            printf("  Inner%9d\n", j);
        } /* end of inner loop */
      } /* end of outer loop */
      return (0);
}
```

Exercise 7.9

- Write a program that uses *for structure* to calculate the value of n!
- Some outputs:

Results

```
Enter n: 4
4! = 24
```

Results

```
Enter n: 0
0! = 1
```

Exercise 7.10

- In mathematics, a **perfect number** is defined as a positive integer which is the sum of its proper positive divisors, that is, the sum of the positive divisors not including the number itself. E.g: 6=1+2+3
- Write a program that lists perfect numbers which is smaller than inputed N.