

4.6 Loops and strings

Students:
Section 4.7 is a part of 2 assignments: CSC108 CH04.7-4.13 C4B ▾
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Includes: CA
Due: 03/13/2025, 11:59 PM EDT

4.7 Nested loops

A **nested loop** is a loop that appears in the body of another loop. The nested loops are commonly referred to as the **inner loop** and **outer loop**.

Nested loops have various uses. One use is to generate all combinations of some items. For example, the following program generates all two-letter .com Internet domain names.

Figure 4.7.1: Nested loops example: Two-letter domain name printing program.

```
#include <iostream>
using namespace std;

/* Output all two-letter .com Internet domain names */

int main() {
    char letter1;
    char letter2;

    cout << "Two-letter domain names:" << endl;

    letter1 = 'a';
    while (letter1 <= 'z') {
        letter2 = 'a';
        while (letter2 <= 'z') {
            cout << letter1 << letter2 << ".com" << endl;
            ++letter2;
        }
        ++letter1;
    }

    return 0;
}
```

Two-letter domain names:
aa.com
ab.com
ac.com
ad.com
ae.com
af.com
ag.com
ah.com
ai.com
aj.com
ak.com
al.com
an.com
av.com
ao.com
ap.com
aq.com
ar.com
as.com
at.com
au.com
av.com
ax.com
ay.com
az.com
ba.com
bb.com
bc.com
bd.com
be.com
...
zx.com
zy.com
zz.com

Feedback?

Note that the program makes use of ascending characters being encoded as ascending numbers, e.g. 'a' is 97, 'b' is 98, etc., so assigning 'a' to letter1 and then incrementing yields 'b'.

(Forget about buying a two-letter domain name: They are all taken, and each sells for several hundred thousand or millions of dollars.

Source: dnjournal.com, 2012).

zyDE 4.7.1: Two character dotcom domain names.

Modify the program to include two-character .com names where the second character can be a letter or a number, as in a2.com. Hint: Add a second loop, following the while (letter2 <= 'z') loop, to handle numbers.

Load default template... Run

```
#include <iostream>
using namespace std;

/* Output all two-letter .com Internet domain names */

int main() {
    char letter1;
    char letter2;

    cout << "Two-letter domain names:" << endl;

    letter1 = 'a';
    while (letter1 <= 'z') {
        letter2 = 'a';
        while (letter2 <= 'z') {
            cout << letter1 << letter2 << ".com" << endl;
            ++letter2;
        }
        ++letter1;
    }

    return 0;
}
```

Feedback?

Below is a nested loop example that graphically depicts an integer's magnitude by using asterisks, creating a "histogram." The inner loop is a for loop that handles the printing of the asterisks. The outer loop is a while loop that handles executing until a negative number is entered.

Figure 4.7.2: Nested loop example: Histogram.

```
#include <iostream>
using namespace std;

int main() {
    int numAsterisk; // Number of asterisks to print
    int i; // Loop counter

    numAsterisk = 0;

    while (numAsterisk >= 0) {
        cout << "Enter an integer (negative to quit): ";
        cin >> numAsterisk;

        if (numAsterisk >= 0) {
            cout << "Depicted graphically:" << endl;
            for (i = 1; i <= numAsterisk; ++i) {
                cout << "*";
            }
            cout << endl << endl;
        }
    }

    cout << "Goodbye." << endl;

    return 0;
}
```

Enter an integer (negative to quit): 9

Enter an integer (negative to quit): 23

Enter an integer (negative to quit): 35

Enter an integer (negative to quit): -1
Goodbye.

Feedback?

PARTICIPATION ACTIVITY | 4.7.1: Nested loops: Inner loop execution.

1) Given the following code, how many times will the inner loop body execute?

```
int row;
int col;

for(row = 0; row < 2; row = row + 1) {
    for(col = 0; col < 3; col = col + 1) {
        // Inner loop body
    }
}
```

Check Show answer

2) Given the following code, how many times will the inner loop body execute?

```
char letter1;
char letter2;

letter1 = 'a';
while (letter1 <= 'f') {
    letter2 = 'a';
    while (letter2 <= 'f') {
        // Inner loop body
        ++letter2;
    }
    ++letter1;
}
```

Check Show answer

Feedback?

PARTICIPATION ACTIVITY | 4.7.2: Nested loops: What is the output.

1) What is output by the following code?

```
int row;
int col;

for(row = 2; row <= 3; row = row + 1) {
    for(col = 0; col <= 1; col = col + 1) {
        cout << row << col << " ";
    }
}
```

Check Show answer

2) What is output by the following code?

```
char letter1;
char letter2;

letter1 = 'y';
while (letter1 <= 'z') {
    letter2 = 'a';
    while (letter2 <= 'c') {
        cout << letter1 << letter2 << " ";
        ++letter2;
    }
    ++letter1;
}
```

Check Show answer

Feedback?

PARTICIPATION ACTIVITY | 4.7.1: Nested loops.

Start

Integers startRange and endRange are read from input. The inner while loop executes (endRange + 1) times for each iteration of the outer while loop. Complete the outer while loop to execute (startRange + 1) times.

Ex: If the input is 5 2, then the output is:

Inner loop ran 18 times

```
#include <iostream>
using namespace std;

int main() {
    int startRange;
    int endRange;
    int count;
    int i;
    int j;
}
```

```
cin >> startRange;
cin >> endRange;
```

```
count = 0;
i = 0;
while /* Your code goes here */ {
    j = 0;
    while (j <= endRange) {
```

1 2 3 4

Check Next level

Feedback?

How was this section? Provide section feedback

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4.8 Developing programs incrementally