

Computer Programming

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Session: Iterative Programs: Putting It All Together

Quick Recap of Relevant Topics



- Iteration idioms in programming
- “**while ...**”, “**do ... while ...**” and “**for ...**” loops in C++
- Use of assignment expressions and their variants in loops
- Use of “**break**” statements in loops

Overview of This Lecture



- Putting things together
 - Writing programs with iteration using what we have learnt
- Use of “break” and “continue” statements

Putting It All Together: An Example



- Given positive integer inputs “m” and “n”, calculate $3^{\min(m, n)}$ and $2^{\max(m, n)}$, and print their values

C++ Program for Min/Max Example



```
int main() {  
    int minMN = 0, maxMN = 0, twoRaisedMax = 1, threeRaisedMin = 1;  
    int m, n, i, j; // Inputs and running counters  
    cout << "Give m and n: "; cin >> m >> n;  
    for (i = m, j = n; ((i >= 1) || (j >= 1)); i--, j--) // Iterate max(m, n) times  
    { if ((i >= 1) && (j >= 1)) { minMN++; threeRaisedMin *= 3; }  
        maxMN++; twoRaisedMax *= 2;  
    }  
    cout << "2^max is: " << twoRaisedMax << ", 3^min is: " << threeRaisedMin;  
    return 0;  
}
```

C++ Program for Min/Max Example



```
int main() {  
    int minMN = 0, maxMN = 0, twoRaisedMax = 1, threeRaisedMin = 1;  
    int m, n, i, j; // Inputs and running counters  
    cout << "Give m and n: "; cin >> m >> n;  
    for (i = m, j = n; ((i >= 1) || (j >= 1)); i--, j--) // Iterate max(m, n) times  
    { if ((i >= 1) && (j >= 1)) { minMN++; threeRaisedMin *= 3; }  
        maxMN++; twoRaisedMax *= 2;  
    }  
    cout << "2^max is: " << twoRaisedMax << ", 3^min is: " << threeRaisedMin;  
    return 0;  
}
```

C++ Program for Min/Max Example



```
int main() {  
    int minMN = 0, maxMN = 0, twoRaisedMax = 1, threeRaisedMin = 1;  
    int m, n, i, j; // Inputs and running counters  
    cout << "Give m and n: "; cin >> m >> n;  
    for (i = m, j = n; ((i >= 1) || (j >= 1)); i--, j--) // Iterate max(m, n) times  
    { if ((i >= 1) && (j >= 1)) { minMN++; threeRaisedMin *= 3; }  
        maxMN++; twoRaisedMax *= 2;  
    }  
    cout << "2^max is: " << twoRaisedMax << ", 3^min is: " << threeRaisedMin;  
    return 0;  
}
```

C++ Program for Min/Max Example



```
int main() {  
    int minMN = 0, maxMN = 0, twoRaisedMax = 1, threeRaisedMin = 1;  
    int m, n, i, j; // Inputs and running counters  
    cout << "Give m and n: "; cin >> m >> n;  
    for (i = m, j = n; ((i >= 1) || (j >= 1)); i--, j--) // Iterate max(m, n) times  
    { if ((i >= 1) && (j >= 1)) { minMN++; threeRaisedMin *= 3; }  
        maxMN++; twoRaisedMax *= 2;  
    }  
    cout << "2^max is: " << twoRaisedMax << ", 3^min is: " << threeRaisedMin;  
    return 0;  
}
```

C++ Program for Min/Max Example



```
int main() {  
    int minMN = 0, maxMN = 0, twoRaisedMax = 1, threeRaisedMin = 1;  
    int m, n, i, j; // Inputs and running counters  
    cout << "Give m and n: "; cin >> m >> n;  
    for (i = m, j = n; ((i >= 1) || (j >= 1)); i--, j--) // Iterate max(m, n) times  
    { if ((i >= 1) && (j >= 1)) { minMN++; threeRaisedMin *= 3; }  
        maxMN++; twoRaisedMax *= 2; }  
    cout << "2^max is: " << twoRaisedMax << ", 3^min is: " << threeRaisedMin;  
    return 0;  
}
```

Conditionally iterate
min(m,n) times

C++ Program for Min/Max Example



```
int main() {  
    int minMN = 0, maxMN = 0, twoRaisedMax = 1, threeRaisedMin = 1;  
    int m, n, i, j; // Inputs and running counters  
    cout << "Give m and n: "; cin >> m >> n;  
    for (i = m, j = n; ((i >= 1) || (j >= 1)); i--, j--) // Iterate max(m, n) times  
    { if ((i >= 1) && (j >= 1)) { minMN++; threeRaisedMin *= 3; }  
        maxMN++; twoRaisedMax *= 2;  
    }  
    cout << "2^max is: " << twoRaisedMax << ", 3^min is: " << threeRaisedMin;  
    return 0;  
}
```

C++ Program for Min/Max Example



```
int main() {  
    int minMN = 0, maxMN = 0, twoRaisedMax = 1, threeRaisedMin = 1;  
    int m, n, i, j; // Inputs and running counters  
    cout << "Give m and n: "; cin >> m >> n;  
    for (i = m, j = n; ((i >= 1) || (j >= 1)); i--, j--) // Iterate max(m, n) times  
    { if ((i >= 1) && (j >= 1)) {  
        minMN++; threeRaisedMin *= 3; // Conditionally iterate min(m,n) times  
    }  
        maxMN++; twoRaisedMax *= 2; // Executed max(m, n) times  
    }  
    cout << "2^max is: " << twoRaisedMax << ", 3^min is: " << threeRaisedMin;  
    return 0;  
}
```

Putting It All Together: Quiz Marks Problem



Read quiz 1 marks of CS101 students one at a time

Any negative marks other than -1000 is invalid and must be ignored

Marks of -1000 denotes end of input

Compute number of valid marks, sum, average, minimum and maximum

C++ Program for Quiz Marks Problem



```
int main () {
    int marks, sum, count, min, max;
    float average;
    for (sum = 0, count = 1;    ; count++) {
        cout << "Give marks of student " << count << ":"; cin >> marks;
        if (marks < 0) { if (marks != -1000) { cout << "Invalid marks!!!" << endl; ...Repeat loop ..}
                         else { cout << "All marks read!!!!" << endl; break; }
        }
        // Update sum, min, max
    }
    average = sum/(count + 0.0);
    cout << "Count of valid marks: " << count << "Sum: " << sum;
    cout << "Average: " << average << "Min: " << min << "Max: " << max << endl;
    return 0;
}
```

C++ Program for Quiz Marks Problem



```
int main () {
    int marks, sum, count, min, max;
    float average;
    for (sum = 0, count = 1;    ; count++) {
        cout << "Give marks of student " << count << ": "; cin >> marks;
        if (marks < 0) { if (marks != -1000) { cout << "Invalid marks!!!" << endl; ...Repeat loop... }
                         else { cout << "All marks read!!!" << endl; break; }
        }
        // Update sum, min, max
    }
    average = sum/(count + 0.0);
    cout << "Count of valid marks: " << count << "Sum: " << sum;
    cout << "Average: " << average << "Min: " << min << "Max: " << max << endl;
    return 0;
}
```

Skip all instructions in body of loop in
this iteration and exit loop

“continue” statement in C++ Program



```
int main () {  
    int marks, sum, count, min, max;  
    float average;  
    for (sum = 0, count = 1;    ; count++) {  
        cout << "Give marks of student " << count << ":"; cin >> marks;  
        if (marks < 0) { if (marks != -1000) { cout << "Invalid marks!!!" << endl; continue; }  
                      else { cout << "All marks read!!!" << endl; break; }  
        }  
        // Update sum, min, max  
    }  
    average = sum/(count + 0.0);  
    cout << "Count of valid marks: " << count << "Sum: " << sum;  
    cout << "Average: " << average << "Min: " << min << "Max: " << max << endl;  
    return 0;  
}
```

Skip all instructions in body of loop in this iteration and start next iteration of loop

C++ Program for Quiz Marks Problem



```
int main () {  
    int marks, sum, count, min, max;  
    float average;  
    for (sum = 0, count = 1;    ; count++) {  
        cout << "Give marks of student " << count  
        if (marks < 0) { if (marks != -1000) {  
            cout << "All marks read." << endl  
            }  
        // Update sum, min, max  
    }  
    average = sum/(count + 0.0);  
    cout << "Count of valid marks: " << count << "Sum: " << sum;  
    cout << "Average: " << average << "Min: " << min << "Max: " << max << endl;  
    return 0;  
}
```

```
    sum = sum + marks;  
    if (count == 1) {min = marks; max = marks; }  
    else {  
        min = (min > marks) ? marks : min;  
        max = (max < marks) ? marks : max;  
    }
```

C++ Program for Quiz Marks Problem



```
int main () {
    int marks, sum, count, min, max;
    float average;
    for (sum = 0, count = 1;    ; count++) {
        cout << "Give marks of student " << count << ": ";
        cin >> marks;
        if (marks < 0) { if (marks != -1000) { cout << "Invalid marks!!!" << endl; continue; }
                         else { cout << "All marks read!!!" << endl; break; }
        }
        // Update sum, min, max
    }
    average = sum/(count + 0.0);
    cout << "Count of valid marks: " << count << "Sum: " << sum;
    cout << "Average: " << average << "Min: " << min << "Max: " << max << endl;
    return 0;
}
```

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Summary



- Examples of two C++ programming problems
- Iterative constructs with assignment expressions