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## ECOR 1606 C Winter 2010 Midterm Exam Solutions

**Instructions:** All code required by this test is to be written in C++. Note that the syntax of the C++ statements required for this test is given on the last page. You must include variable declarations in your code. Note that all expressions (the right hand sides of assignments, conditions in while loops, etc.) must be strictly correct. You cannot use words like "and" and "or" but must instead use the appropriate C-/C++ operators. You do **not** need to write any of the code from "framework.cpp" (e.g. int main(), etc.).

### Question 1 (5 marks): (1 mark each answer)

**Note: deduct 1 mark if the student has included "a=" and/or "b=" in his/her answers.**

What will be output by each of the following program segments? Assume that a and b have been declared as integers at the beginning of each program (not shown here).

(i) `b = 15;`  
`cout << b / 2 << endl;`

**7**

(ii) `a = 6; b = 10;`  
`do {`  
    `b = b + a;`  
    `a = a + 1;`  
`} while (b < 15);`  
`cout << a << " " << b << endl;`

**7 16**

(iii) `a = 3; b = 5;`  
`while (a < 5 && b < 8) {`  
    `a = a + 1; b = b + 2;`  
`} // end while`  
`cout << a << " " << b << endl;`

**5 9**

**Question 2 (5 marks):**

Write a program that reads in two integer values and that outputs all of the integers between the two values (excluding the values themselves) that are not divisible by 4. Each value must be output on a separate line and values must be output in ascending order. The following sample run should give the idea. User inputs are in **bold**. Note that you may **not** assume that the first value entered is greater than or equal to the first (i.e. the two values may be entered in any order).

Enter two values: **18 12**

13

14

15

17

```
int a, b, temp, i; // ½ mark
```

```
cout << "Enter two values: "; // ½ mark
```

```
cin >> a >> b; // ½ mark
```

```
if (a>b) { // 1 mark
```

```
    temp = a; a = b; b = temp; // now a is guaranteed to be <=b
```

```
} // end if
```

```
i=a+1;
```

```
while(i<b) { // 1 mark for while loop
```

```
    if (i%4!=0) { // 1 mark for if
```

```
        cout << i << endl;
```

```
    }
```

```
    i++; // ½ mark
```

```
} // end while
```

**Note: Students can also use a for loop for the last part:**

```
// i initialization now part of loop
```

```
for(i=a+1; i<b; i++) { // 1.5 marks for for loop
```

```
    // i increment now part of loop
```

```
} // end for
```

**Question 3 (3 marks):**

Suppose that we would like an expression that is the logical opposite of

`(a <= b) && (c > 10)`

Show how such an expression can be created using the NOT operator:

**`!(a<=b) && (c>10)` or `!(a<=b && c>10)` 1 mark**

Show how such an expression can be created without using the NOT operator:

**`(a>b) || (c<=10)` or `a>b || c<=10` 2 marks (1 for first half, ½ each for || and 2<sup>nd</sup> half)**

**Question 4 (8 marks): (2 marks each)**

Some or all of the code snippets below contain obvious programming errors. Identify the erroneous snippets and show how the errors could be corrected. Assume that all variables used have been declared (as being of type "double") and that all have been given values.

i) `if (a >= b >=c) {`  
    `cout << "b is between a and c (inclusive)." << endl;`  
    `} // end if`

**`(a >=b >=c)` should be `((a>=b) && (b>=c))` (interior brackets optional and first part could be `b<=a`, etc.)**

ii) `while (a>10) {`  
    `cout << "The value is greater than 10." << endl;`  
    `} // end while`

**`while (a > 10)` should be `if (a > 10)`  
**optional (not required for full marks): `// end while` should be `//end if`****

iii) `if ((a && b && c) = 0) {`  
    `cout << "All of the values are equal to zero." << endl;`  
    `} // end if`

**`((a && b && c) = 0)` should be `((a==0) && (b==0) && (c==0))` (interior brackets optional and must be `==` not `=`)**

```
iv) while (a = 7) {
    cout << "The variable is equal to seven." << endl;
    a == a+1;
} // end while
```

**(a = 7) should be (a == y)**  
**a == a+1; should be a = a+1; (or a+=1; or a++;)**

**Question 5 (6 marks): (2 marks each)**

i) A student is special if his/her mark is below 40 or over 90 (exclusive of these values). Complete the "if" statement below. Assume that the student's mark is stored in a variable called *mark*.

```
if ( mark<40 || mark>90 ) { // or (mark<40) || (mark>90)
    cout << "The student is special." << endl;
} // end if
```

ii) A student gets an A if he/she gets at least 90 on the final exam, or if his/her term work is at least 85 and he/she gets over 80 on the final exam. Complete the "if" statement below. Assume that the final exam mark is stored in variable *final* and the term work mark in variable *term*.

```
if ( !( (final>=90) || ((term>=85 && final>80)) ) ) { // interior brackets optional but !(...) required
    cout << "The student does not get an A." << endl;
} // end if
```

**or: final<90 && (term<85||final<=80) -- these brackets required (extra ones are fine)**

iii) Assume three variables called *a*, *b*, and *c*. Looping is to continue as long as at least two of these variables are not -1. Complete the "while" statement below.

```
while ( (a!=-1&&b!=-1) || (a!=-1&&c!=-1) || (b!=-1&&c!=-1) ) { // brackets optional
    // do something or other ...
} // end while
```

**or: !(a==1||b==1) || !(a==1||c==1) or !(b==1||c==1) (brackets required)**

**or: (a==1||b==1) && (a==1||c==1) && (b==1||c==1) (brackets required)**

**Question 6 (8 marks):**

An Olympic event involves two runs and four judges. Each judge comes up with a score out of 10 based on both runs. A competitor's score is calculated by adding the average time for the two runs to the best and worst of the four judge's scores. Write a program that reads in the two times and the judges' scores and outputs the competitor's score. The sample run below should give the idea. User input is in **bold**. Note that each prompt message should include the run / judge number, and that you will not get full marks unless your program involves at least one loop.

```
Enter time for run 1: 18.2
Enter time for run 2: 16.8
Enter score from judge 1: 8.3
Enter score from judge 2: 8.0
Enter score from judge 3: 9.1
Enter score from judge 4: 8.6
```

The competitor's score is 34.6

```
double time, score, total=0, highest, lowest; // ½ mark for declarations / initializations
int judge, run;
```

```
run = 1;
```

```
while (run <=2) { // loop optional (just one loop required in program, but 2 is fine)
    cout << "Enter time for run " << run << ": "; // 1 mark for cout and cin
    cin >> time;
    total += time; // or total = total + time; ½ mark
    run++; // or run+=1; or run = run + 1;
}
```

```
judge = 1;
```

```
while (judge <= 4) { // 1 mark for while loop
```

```
    cout << "Enter score from judge " << judge << ": "; // 1 mark for cout and cin
    cin >> score;
```

```
    if (judge==1 || score > highest) { // 1 mark
        highest = score;
    } // end if
```

```
    if (judge==1 || score < lowest) { // 1 mark
        lowest = score;
    } // end if
```

```
    judge++; // or judge+=1; or judge = judge + 1; ½ mark
} // end while
```

```
cout << "The competitor's score is " << total/2 + highest + lowest << endl; // 1.5 marks
```

**Alternate solution for first part (without loop):**

```
cout << "Enter time for run 1: ";
cin >> total;
cout << "Enter time for run 2: ";
cin >> time;
total += time; // or total = total + time;
```

**Note: Can also use for loop(s) instead of while(s), e.g.:**

```
// initialization of judge now in "for"
for(judge=1; judge <= 4; judge++) { // 1.5 marks for loop
    ...
    // increment of judge now in "for"
} // end for (and similarly for first loop above)
```