Spring Semester 16, Dr. Punch. Exam #3 (05/07), form 3 A

Last name (printed): ____________________________________________

First name (printed): __________________________________________

**Directions:**

a) DO NOT OPEN YOUR EXAM BOOKLET UNTIL YOU HAVE BEEN TOLD TO BEGIN.
b) You have 120 minutes to complete the exam (7:45-9:45)
c) This exam booklet contains 40 multiple choice questions, each weighted equally (5 points). **6 double-sided pages in total**
d) You may use one 8.5” x 11” note sheet during the exam. No other reference materials or calculating devices may be used during the examination.
e) Questions will not be interpreted during the examination.
f) You should choose the single best alternative for each question, even if you believe that a question is ambiguous or contains a typographic error.
g) Please fill in the requested information at the top of this exam booklet.
h) Use a #2 pencil to encode any information on the OMR form.
i) Please encode the following on the OMR form:
   ■ Last name and first initial
   ■ MSU PID
   ■ Exam form (see the title of this page)
j) Please sign the OMR form.
k) Only answers recorded on your OMR form will be counted for credit.
l) Completely erase any responses on the OMR form that you wish to delete.
m) You must turn in this exam booklet and the OMR form when you have completed the exam. When leaving, please be courteous to those still taking the exam.

Good luck.

**Timing tip.** A rate of 2.75 minutes per multiple choice problem leaves 10 minutes to go over any parts of the exam you might have skipped.
1) For the program in Figure 1, what output is given by Line 1?
   a) 0  
   b) 10  
   c) 25  
   d) 35  
   e) None of the above.
2) For the program in Figure 1, what output is given by Line 2?
   a) 0
   b) 10
   c) 25
   d) 35
   e) None of the above.

3) For the program in Figure 1, what output is given by Line 3?
   a) 2
   b) 5
   c) 14
   d) 22
   e) None of the above.

4) For the program in Figure 1, what output is given by Line 4?
   a) 2
   b) 3
   c) 4
   d) 5
   e) None of the above.

5) For the program in Figure 1, what output is given by Line 5?
   a) 2
   b) 3
   c) 4
   d) 5
   e) None of the above.

6) For the program in Figure 1, what output is given by Line 6?
   a) 1
   b) 2
   c) 3
   d) 4
   e) None of the above.

7) For the program in Figure 1, what output is given by Line 7?
   a) 1
   b) 2
   c) 3
   d) 4
   e) None of the above.

8) For the program in Figure 1, what output is given by Line 8?
   a) 1
   b) 2
   c) 3
   d) 4
   e) None of the above.
9) For a balanced (all leaves at the same depth) binary search tree, what is the Big O to find a particular node?  
   a) O(1)  
   b) O(log₂(n))  
   c) O(n)  
   d) O(n²)  
   e) None of the above

10) If a class constructor is marked with `=delete` in the class header file, what does that mean?  
    a) The destructor for that constructor is automatically created  
    b) That constructor is not available to be used anywhere in the code  
    c) The default C++ constructor will be used  
    d) It marks the constructor as requiring a destructor  
    e) None of the above

11) Which of the following represents the best meaning of the `delete` operator?  
    a) memory is removed the operating system.  
    b) access to hidden memory in the operating system is removed  
    c) the operating system gains access back to memory used by your running code  
    d) what it does depend on which operating system you are using.  
    e) None of the above.

12) Which of the following are true about STL vectors?  
    a) They have a `push_back` operator.  
    b) They have an `emplace_back` operator  
    c) Operations on vectors are copy operations unless indicated otherwise.  
    d) All of the above  
    e) None of the above

13) Which of the following is true regarding an STL `transform` algorithm on a container?  
    a) Can only be used on sequential containers (strings, vectors, deques).  
    b) Does not require the use of iterators.  
    c) Requires a function/lambda to apply to each element  
    d) All of the above  
    e) None of the above

14) Which of the following are true about a class method that is marked as `explicit`?  
    a) It can be invoked by the programmer in their code  
    b) It cannot be invoked by the compiler for implicit conversions  
    c) Requires the programmer to cast a conversion for it to occur  
    d) All of the above  
    e) None of the above
```cpp
#include<iostream>
using std::cout; using std::endl;
#include<vector>
using std::vector;
#include<string>
using std::string; using std::to_string;
#include<utility>
using std::pair;
#include<numeric>
using std::accumulate;

using pr = pair<string, long>; // global type shortcut

long a_fn(long val, pr ele){
    return val + ele.second*2;
}

string f1(const vector<pr>& v, size_t i){
    pr t;
    if (i < v.size()){
        t = v[i];
        return t.first+""+to_string(t.second);
    } else
        return "";
}

long f2 (const vector<pr>& v){
    return accumulate(v.begin(), v.end(), 0, a_fn);
}

long f3 (vector<pr>& v, char c, long l){
    long cnt = 0;
    for (auto &e : v){
        if (e.first.find(c) != string::npos) {
            e.first = e.first+c;
            e.second = l;
            cnt++;
        }
    }
    return cnt;
}

int main (){  
    vector<pr> v = {{"bill", 2},{"fred", 4},{"bob",6}};
    cout << f1(v,0) << endl;  // Line 3
    cout << f1(v,3) << endl;  // Line 4
    cout << f2(v) << endl;  // Line 5
    cout << f1(v,0) << endl;  // Line 6
    cout << f3(v,'b',10) << endl;  // Line 7
    cout << f1(v,0) << endl;  // Line 8
} 
```

Figure 2
15) For the program in Figure 2, what is the **full type description** for e on Line 1?
   a) string
   b) long
   c) pair<string,long>::iterator
   d) pair<string,long>
   e) None of the above

16) For the program in Figure 2, what does string::npos represent on Line 2?
   a) the character was not found (no such position)
   b) the character was found at the end position
   c) a special string, the empty string (null string)
   d) the character was found at the next position (next pos)
   e) None of the above

17) For the program in Figure 2, what value is output on Line 3?
   a) bob:6
   b) fred:4
   c) bill:2
   d) empty string
   e) None of the above

18) For the program in Figure 2, what value is output on Line 4.
   a) bob:6
   b) fred:4
   c) bill:2
   d) empty string
   e) None of the above

19) For the program in Figure 2, what value is output on Line 5.
   a) 2
   b) 4
   c) 6
   d) 12
   e) None of the above

20) For the program in Figure 2, what value is output on Line 6.
   a) bob:6
   b) fred:4
   c) bill:2
   d) empty string
   e) None of the above

21) For the program in Figure 2, what value is output on Line 7.
   a) 2
   b) 4
   c) 6
   d) 12
   e) None of the above
22) For the program in Figure 2, what value is output on Line 8.
   a) bob:6
   b) fred:4
   c) bill:2
   d) empty string
   e) None of the above
Figure 3 is one program. Program starts on the left and continues with the main() inset.
23) For the program in Figure 3, what output is produced by Line 1?
   a) 0
   b) 1
   c) 2
   d) 3
   e) None of the above
24) For the program in Figure 3, what output is produced by Line 2?
   a) abc
   b) cab
   c) cba
   d) empty string
   e) None of the above
25) For the program in Figure 3, what output is produced by Line 3?
   a) abc
   b) cab
   c) cba
   d) empty string
   e) None of the above
26) For the program in Figure 3, what output is produced by Line 4?
   a) 0
   b) 1
   c) 2
   d) 3
   e) None of the above
27) For the program in Figure 3, what output is produced by Line 5?
   a) 0
   b) 1
   c) 2
   d) 3
   e) None of the above
28) For the program in Figure 3, what output is produced by Line 6?
   a) f
   b) e
   c) d
   d) a
   e) None of the above
29) For the program in Figure 3, what output is produced by Line 7?
   a) 0
   b) 1
   c) 2
   d) 3
   e) None of the above
30) For the program in Figure 3, what output is produced by Line 8?
   a) f
   b) e
   c) d
   d) a
   e) None of the above
For the program in Figure 4, what output is produced by Line 1?

31) a) abcde  
b) ab  
c) cd  
d) e  
e) None of the above
32) For the program in Figure 4, what output is produced by Line 2?
   a) abcde
   b) ab
   c) cd
   d) e
   e) None of the above

33) For the program in Figure 4, what output is produced by Line 3?
   a) 0
   b) 1
   c) 2
   d) 3
   e) None of the above

34) For the program in Figure 4, what output is produced by Line 4?
   a) abcde
   b) ab
   c) cd
   d) e
   e) None of the above

35) For the program in Figure 4, what output is produced by Line 5?
   a) 0
   b) 1
   c) 2
   d) 3
   e) None of the above
Figure 5 is one program. Program starts in column 1 and continues in column 2.
36) For the program in Figure 5, what output is produced on Line 1?
   a) 100
   b) 101
   c) 102
   d) 30
   e) None of the above

37) For the program in Figure 5, what output is produced on Line 2?
   a) 100
   b) 101
   c) 102
   d) 30
   e) None of the above

38) For the program in Figure 5, what output is produced by Line 3?
   a) 0
   b) empty string
   c) 101
   d) 102
   e) None of the above

39) For the program in Figure 5, what output is produced by Line 4?
   a) 100
   b) 101
   c) 102
   d) fred
   e) None of the above

40) For the program in Figure 5, what output is produced by Line 5?
   a) 100
   b) 1000
   c) 101
   d) 1001
   e) None of the above