Fall Semester 17, Dr. Punch. Exam #3 (12/13), 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 (8pm-10pm)
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 is the type of `res1` on Line 1?
   a) long
   b) `long`
   c) `long`&
   d) `size_t`
   e) None of the above.

2) For the program in Figure 1, what output is given by Line 2?
   a) 30
   b) 40
   c) 50
   d) some address
   e) None of the above.
3) For the program in Figure 1, what output is given by Line 3?
   a) 30
   b) 40
   c) 50
   d) some address
   e) None of the above.

4) For the program in Figure 1, what output is given by Line 4?
   a) 30
   b) 40
   c) 50
   d) some address
   e) None of the above.

5) For the program in Figure 1, what output is given by Line 5?
   a) 30
   b) 40
   c) 50
   d) some address
   e) None of the above.

6) For the program in Figure 1, what output is given by Line 6?
   a) 30
   b) 40
   c) 50
   d) some address
   e) None of the above.

7) For the program in Figure 1, what output is given by Line 7?
   a) true
   b) false
   c) 1
   d) 0
   e) None of the above.
8) What is the "rule of three" for C++ classes?
   a) If you provide a copy constructor, destructor or operator=, you should provide them all.
   b) You must provide three constructors in a dynamic memory class
   c) There should be no more than three private variables in a class.
   d) You need a destructor if the size of a private data member dynamic array is bigger than 3.
   e) None of the above

9) What is the Big O rating for a selection sort?
   a) O(1)
   b) O(n * log(n))
   c) O(n)
   d) O(n^2)
   e) None of the above

10) Which of the following represents the best meaning of the new operator?
    a) more memory is provided to the operating system.
    b) provides access to hidden memory in the operating system
    c) what it does depend on which operating system you are using.
    d) the operating system marks some memory as owned by your running code.
    e) None of the above.

11) Which of the following are true about STL vectors and a regular C++ arrays?
    a) Both have their first value at index 0
    b) Both can use generic algorithms by using STL iterators.
    c) Both are fixed in their size.
    d) All of the above.
    e) None of the above

12) Which of the following is true regarding an STL accumulate algorithm on a container?
    a) Only works on numeric values.
    b) Assumes the existence of an operator+ on the container's values.
    c) Requires a single pointer/iterator argument to the first value, no other arguments
    d) All of the above
    e) None of the above

13) Which of the following are true about a class constructor?
    a) It cannot be explicitly invoked
    b) Has the same name as the class
    c) Has a return value of a class instance
    d) All of the above
    e) None of the above

14) How many children can a node in a binary tree have?
    a) 0
    b) 1
    c) 2
    d) All of the above
    e) None of the above
15) For the program in Figure 2, what type is e on Line 1 given the call on Line 3?
   a) long
   b) long*
   c) vector<long>::iterator
   d) vector<long>
   e) None of the above
16) For the program in Figure 2, what type is \texttt{res1} on Line 2 given the call on Line 6?
   a) \texttt{char}
   b) \texttt{string}
   c) \texttt{vector*}
   d) \texttt{string*}
   e) None of the above

17) For the program in Figure 2, what value is output on Line 3?
   a) 3
   b) 4
   c) 5
   d) 6
   e) None of the above

18) For the program in Figure 2, what value is output on Line 4.
   a) ab
   b) abab
   c) cdef
   d) empty string
   e) None of the above

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

20) For the program in Figure 2, what value is output on Line 6?
   a) 1
   b) 2
   c) 3
   d) 4
   e) None of the above
// Let's assume I got the includes right

struct MyStruct {
    long l1 = 0;
    long l2 = 0;

    MyStruct() = default;
    MyStruct(long p1, long p2): l1(p1), l2(p2) {} ;
};

void fn1(MyStruct& s, long lng){
    s.l1 += lng;
    s.l2 += lng;
}

MyStruct fn2(MyStruct s1, MyStruct s2){
    MyStruct res;
    res.l1 = s1.l1 * s2.l1;
    res.l2 = s1.l2 * s2.l2;
    return res;
}

bool fn3(const MyStruct& s1, const MyStruct& s2){
    auto res1 = static_cast<double>(s1.l1)/s1.l2;    // Line 1
    auto res2 = static_cast<double>(s2.l1)/s2.l2;
    return res1 > res2;
}

int main (){
    MyStruct s1;
    MyStruct s2(2,2);
    cout << s1.l1 << endl;  // Line 2
    cout << s2.l1 << endl;  // Line 3
    fn1(s1,1);
    cout << s1.l1 << endl;  // Line 4
    auto res = fn2(s1,s2); // Line 5
    cout << res.l1 << endl; // Line 6

    vector<MyStruct> v{ {1,2}, {3,3}, {4,5} };   
    sort(v.begin(), v.end(), fn3);
    cout << v[0].l2 << endl;  // Line 7
}

Figure 3
21) For the program in Figure 3, what type is `res1` on Line 1?
    a) `size_t`
    b) `double`
    c) `long`
    d) `int`
    e) None of the above

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

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

25) For the program in Figure 3, what type is `res` on Line 5?
    a) `size_t`
    b) `double`
    c) `long`
    d) `int`
    e) None of the above

26) For the program in Figure 3, what output is produced by Line 6?
    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 7?
    a) 0
    b) 1
    c) 2
    d) 3
    e) None of the above
Figure 4 has a class definition and a main program inset.

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

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

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

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

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

34) For the program in Figure 4, what output is produced by Line 7?
   a) 1
   b) 2
   c) 3
   d) 4
   e) None of the above
35) For the program in Figure 4, what output is produced by Line 8?
   a) 0
   b) 2
   c) 3
   d) 4
   e) None of the above
```cpp
// Let's assume I got all the includes right
template<typename K, typename V>
class AClass {
public: // everything public for easier testing
    map<K,V> mp_;
    vector<K> vec_;

    AClass() = default;
    void method_1(K, V);
    pair<K, V> method_2();
};

template<typename K, typename V>
void AClass<K, V>::method_1(K k, V v){
    vec_.push_back(k);
    mp_[k] = v;
}

template<typename K, typename V>
pair<K, V> AClass<K, V>::method_2(){
    K tempk = mp_.begin() -> first;
    V tempv = mp_.begin() -> second;
    for(auto i = mp_.begin(); i != mp_.end(); ++i){ // Line 1
        if(i->first > tempk)
            tempk = i->first;
        if(i->second > tempv)
            tempv = i->second;
    }
    return make_pair(tempk, tempv);
}

int main(){
    AClass<string, char> ac_1;
    ac_1.method_1("elle", 'e');
    ac_1.method_1("bill", 'l');
    ac_1.method_1("fred", 'd');
    cout << (ac_1.mp_.begin() ) -> first << endl; // Line 2
    cout << ac_1.vec_[0] << endl; // Line 3

    AClass<long, long> ac_2;
    ac_2.method_1(10, 20);
    ac_2.method_1(5, 10);
    ac_2.method_1(3, 50);
    auto res = ac_2.method_2();
    cout << res.first << endl; // Line 4
    cout << (ac_2.mp_.begin() ) -> first << endl; // Line 5
}
```

Figure 5
36) What type is variable \( i \) on Line 1 of Figure 5 given the invocation \( \text{ac}_1.\text{method}_2() \)?
   a) \( \text{pair}<\text{string, char}> \)
   b) \( \text{map}<\text{string, char}>::\text{iterator} \)
   c) \text{size_t} 
   d) \text{string} 
   e) None of the above

37) What value is output on Line 2 of Figure 5?
   a) \text{elle} 
   b) \text{bill} 
   c) empty string 
   d) \{"elle":'e'\}, a pair<string,char> 
   e) None of the above

38) What value is output on Line 3 of Figure 5?
   a) \text{elle} 
   b) \text{bill} 
   c) empty string 
   d) \{"elle":'e'\}, a pair<string,char> 
   e) None of the above

39) What value is output on Line 4 of Figure 5?
   a) 5 
   b) 10 
   c) 20 
   d) 50 
   e) None of the above

40) What value is output on Line 5 of Figure 5?
   a) 5 
   b) 10 
   c) 20 
   d) 50 
   e) None of the above