

Student Number:

Name:

Write down answers in-between questions. Please answer using short sentences.

The back of each page can be used for practice, but DO NOT write down the answer on the back.

Be sure to write your student number and name on each page.

1. (10 pts) True / False questions:

- 1) In C, arrays and pointers can always be used in the same way. ()
- 2) In C, when passing an array as an argument to a function, if only the name of the array is passed as an argument, the length of the array can be found within the function. ()
- 3) In `const int* ptr= #`, the value of the pointer `ptr` cannot be changed after it is initialized. ()
- 4) If the size of the memory space allocated by `new` is very small, there is no need to delete it. ()
- 5) If memory allocation is requested dynamically during program execution, it is allocated in a memory space called the 'stack'. ()
- 6) When passing a pointer array as an argument to a function, a double pointer (pointer to pointer) must be used as corresponding parameter type. ()
- 7) If you don't set any access specifier for class members, they are considered private. ()
- 8) If a member function is defined inside a class definition, the compiler always generates binary code for it as an inline function. ()
- 9) Using `std::list` will always produce faster performance than using `std::vector`. ()
- 10) The elements of `std::list` are stored in contiguous memory. ()

2. (4 pts) After running `make` once using the Makefile below, you modified the `read.c` file. What are newly created files when you run `make` again?

```
test : read.o write.o main.o
      gcc -o test read.o write.o main.o

main.o : io.h main.c
      gcc -c main.c

read.o : io.h read.c
      gcc -c read.c

write.o: io.h write.c
      gcc -c write.c
```

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3. (4 pts) Choose **ALL** that are **not appropriate** to fill in blank (a).

```
#include <stdio.h>
typedef struct
{
    int xpos;
    int ypos;
} Point;

int main()
{
    Point points[5];
    for(int i=0; i<5; ++i)
    {
        points[i].xpos = i;
        points[i].ypos = i*2;
    }

    for(int i=0; i<5; ++i)
    {
        printf("%d %d\n", points[i].xpos, _____ (a) );
    }

    return 0;
}
```

- 1) points[i].ypos 2) (&points[i])->ypos 3) (&points[i]).ypos
 4) (points+i)->ypos 5) (points+i).ypos 6) (*(points+i))->ypos 7) (*(points+i)).ypos

4. (6 pts) Choose **ALL** the **incorrect** implementations of the swap function that swaps the values of two integer variables.

```
void swap( int a, int b){
    int tmp = b;
    b = a;
    a = tmp;
}
```

1)

```
void swap(int* a, int* b){
    int tmp = *b;
    *b = *a;
    *a = tmp;
}
```

2)

```
void swap( int* const a, int* const b){
    int tmp = *b;
    *b = *a;
    *a = tmp;
}
```

3)

```
void swap( const int* a, const int* b){
    int tmp = *b;
    *b = *a;
    *a = tmp;
}
```

4)

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5. (4 pts) How many bytes should be allocated at a minimum for a char array to hold the string 'Hello World' ?
6. (6 pts) Write down the expected result of running the following program with the given standard input.

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

int main () {
    string str;
    for(int i=0; i<3; i++)
        getline(cin, str, ',');
    cout << str << endl;

    return 0;
}
```

The given standard input (↵ means pressing Enter key):

```
creative,software,design↵
exam,↵
```

7. (6 pts) Fill in the blanks so that the following program successfully compiles and runs without a memory leak.

```
#include <iostream>
using namespace std;
int main()
{
    int n;
    cin >> n;

    _____ num = _____ int;
    _____ numArr = _____ int[n];

    *num = n;
    for(int i=0; i<n; i++)
        numArr[i] = i;

    cout << *num << endl;
    for(int i=0; i<n; i++)
        cout << numArr[i] << " ";
    cout << endl;

    _____ num;
    _____ numArr;

    return 0;
}
```

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8. (4 pts) What is the expected output of the following program?

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

int sum(int x, int y, int z=100, int w=10)
{
    return (x + y + z + w);
}
int main()
{
    cout << sum(10, 20, 30) << endl;
    return 0;
}
```

- 1) 60 2) 140 3) 130 4) 70 5) A compile error occurs

9. (5 pts) What is the expected output of this program when you run it as shown in the lower left? (the executable name is 'test')

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

int main(int argc, const char **argv)
{
    cout << argv[1] + argv[3] << endl;
}
```

```
$ ./test 1 3 5 7
```

- 1) ./test3 2) 15 3) 6 4) 10 5) A compile error occurs

10. (4 pts) Write down the expected output of the following program.

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

void f1(int x) { x++; }
void f2(int& x) { x++; }

int main()
{
    int p = 65;
    int q = 65;
    f1(p);
    f2(q);
    cout << p << " " << q << endl;
    return 0;
}
```

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11. (10 pts) Fill in the blanks in the outputs of the following program.

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

int main() {
    int a[] = { 0, 1, 2, 3, 4, 5, 6, 7, 8 };
    const int num_a = sizeof(a) / sizeof(int);

    int* pa[] = { &a[0], &a[2], &a[4], &a[6], &a[8] };
    const int num_pa = sizeof(pa) / sizeof(int*);

    int* p = &a[3];
    ++p;
    *p = 9;

    const int* q = &a[0];
    q += 2;

    int*& pr1 = pa[1];
    pr1 = pa[2];

    cout << "a = {";
    for (int i = 0; i < num_a; ++i)
        cout << " " << a[i];
    cout << "}" << endl;

    cout << "=====" << endl;

    for (int i = 1; i < num_pa; ++i) --(pa[i]);
    for (int i = 1; i < num_pa; ++i) --(*pa[i]);

    cout << "a = {";
    for (int i = 0; i < num_a; ++i)
        cout << " " << a[i];
    cout << "}" << endl;

    return 0;
}

// output:
// a = { _____(a)_____ }
// =====
// a = { _____(b)_____ }
```

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12. (6 pts) Select **ALL** the code that can be in the blank line _____ of the following code.

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

class Test{
public:
    Test(int a, int b) {}
    Test(int a) {}
    Test(char c) {}
    ~Test() {}
};

int main() {
    Test _____
}
```

- 1) test(1, 2);
- 2) test;
- 3) test(3);
- 4) test("a");
- 5) None of the above

13. (6 pts) The following program generates a compile error. Add **ONLY ONE** line of code to the following program so that the program compiles successfully and outputs the below result.

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

class MyString
{
public:
    string str;
    MyString(const string& b) { str = b; }
};

int main()
{
    MyString str1;
    str1.str = "abc";
    MyString str2("def");
    cout << str1.str << endl;
    cout << str2.str << endl;

    return 0;
}
```

Output:

```
abc
def
```

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14. (5 pts) Write down the expected output of the following program.

```
#include <iostream>
#include <string>
using namespace std;
class A{
public:
    A() { cout << "a1 "; }
    ~A() { cout << "a2 "; }
};

class B{
public:
    B() { cout << "b1 "; }
    ~B() { cout << "b2 "; }
};

class C{
public:
    C() { cout << "c1 "; }
    ~C() { cout << "c2 "; }
};

void test2(){ C c; }
void test(){ B b; test2(); }

int main(){
    A a;
    test();
    return 0;
}
```

15. (4 pts) Write down the expected output of this program.

```
#include <iostream>
#include <vector>
using namespace std;
int main ()
{
    vector<int> vec(5);
    for(int i=0; i<vec.size(); ++i)
        vec[i] = 2*i;

    vector<int>::iterator it = vec.begin();
    *it = 8;
    *(it+2) = 9;

    for(int i=0; i<vec.size(); ++i)
        cout << vec[i] << " ";
    cout << endl;

    return 0;
}
```

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16. (10 pts) A palindrome is a word which reads the same backward as forward. For example, noon, level, kayak, etc. are palindromes. The `isPalin()` function below is a function that tests whether a given word is palindrome or not (returns true only if the input string `s` is palindrome). Fill in the blanks (a), (b) of the `_isPalin()` function for this to work. Also write down the output (c)-(f) when running.

```
bool _isPalin(const string& s, int begin, int end) {
    if (begin >= end-1) return true;
    return ( _____ (a) _____ ) &&
           ( _____ (b) _____ );
}

bool isPalin(const string s) {
    if (s.empty())
        return false;
    else
        return _isPalin(s, 0, s.size());
}

int main() {
    cout << "isPalin(\"abcdcdcba\")? " << isPalin("abcdcdcba") << endl;
    cout << "isPalin(\"ab\")? " << isPalin("ab") << endl;
    cout << "isPalin(\"a\")? " << isPalin("a") << endl;
    cout << "isPalin(\"\")? " << isPalin("") << endl;
}
// output:
//     isPalin("abcdcdcba")? _____ (c) _____
//     isPalin("ab")? _____ (d) _____
//     isPalin("a")? _____ (e) _____
//     isPalin("")? _____ (f) _____
```

17. (6 pts) What is the expected output of the following program? Fill in the blanks.

```
#include <vector>
#include <iostream>
using namespace std;
int main(void) {
    vector<int> v(10);
    for (int i = 0; i < v.size(); ++i) v[i] = i;

    cout << "print 1: ";
    for (vector<int>::iterator it=v.begin()+1; it<v.end(); it=it+2)
        cout << " " << *it;
    cout << endl;

    cout << "print 2: ";
    for (vector<int>::reverse_iterator it=v.rbegin()+1; it<v.rend(); it=it+2)
        cout << " " << *it;
    cout << endl;
}
```

print 1: _____ (a) _____
 print 2: _____ (b) _____

Output: