The final of CS 135, Fall 2020

Name: ________________________ Student ID:

1. (1 point each, 10 points total) True or false.
   (1) To find out the square root of 4, we can use sqrt(4);
   (2) An object is the blueprint from which classes are made.
   (3) Encapsulation (also called information hiding) combines data members and method members and hide the implementation details from the clients of a class.
   (4) In general, it is a good practice to access data members of one class from another class without using getter methods of the former class.
   (5) Since each manager is an employee, we can design Manager class as a subclass of Employee class.
   (6) A method can use a pointer to superclass as parameter. When we call this method, we cannot pass a pointer to subclass object of the superclass to that method.
   (7) A static data member of a class is stored in every object.
   (8) A virtual method declared in superclass can be overridden in subclassed.
   (9) The size of one dimensional array arr can be found by arr.size().
   (10) In general, when we define a class, we should declare data member as public and operations on those data members as private.

2. (2 points each) Choose the best solution for a multiple-choice problem.
   (1) Given string names[][3] = { {"Ann", "Bonny", "Cheryl"}, {"Abel", "Bob", "Charles"}}; What is names[1][0].size()?
   (A) 3
   (B) 4
   (C) 5
   (D) 6

   (2) What is vect.size() after the following code?

```
vector<int> vect;
vect.push_back(1);
vect.push_back(2);
vect.pop_back();
vect.push_back(3);
```

   (A) 0
   (B) 1
   (C) 2
   (D) 3

(3) Given int arr[] = {0, 1, 6}, what is the value of arr[3]?
(A) 0
(B) 1
(C) 6
(D) Invalid since the maximum index of arr is 2.

(4) Choose all valid statements. Which of the following is the most appropriate?
(A) int a = "hello";
(B) double b = 2;
(C) int c = (int) 2.6;
(D) Both (B) and (C)
(E) all of the above

(5) What is the value of 1 / 2 * 3.0?
(A) 0
(B) 1
(C) 0.67
(D) 1.5

(6) Suppose there is a data member as int* called *grades*. What should be the code of void setGrades(int grades[], int size) looks like (choose all answers that may apply)? For simplicity, you do not need to check the validity of each element in grades. Do not need to worry about modification of data member size.

```
(A) this->grades = new int[size];
    for (int i = 0; i < size; i++)
        this->grades[i] = grades[i];
```

(B) this->grades = grades;
(C) return grades;
(D) Either (A) or (B)

(7) Suppose Dog class extends from Animal class and has a default constructor. Which is correct?

```
Animal* a;
Dog* dog = new Dog();
```

(A) a = dog;
(B) dog = a;
(C) both (A) and (B)
(D) neither (A) nor (B)

(8) Suppose we have Rectangle class, which has data member length and width. What can we say about the constructor of Rectangle?
(A) Constructor can have a name different from Rectangle.

(B) The return type of constructor can be void or other type.
(C) We can have constructor Rectangle(int length) and Rectangle(int width) at the same time.
(D) None of the above.

(9) Road class has constructor to create a road with n blocks, where n is a positive int:

```
Road(int n)
```

How to declare and instantiate a Road object *road* with 80 blocks?

(A) Road road = 80;
(B) Road road = new Road(80);
(C) Road road (80);
(D) None of the above.

(10) Given API of getLastBlock method of Road class as follows. Suppose Road object rd has been properly declared and instantiated, how to find out the last block of rd?

```
int getLastBlock() const;
```

(A) int lastBlock = Road::getLastBlock();
(B) int lastBlock = rd.getLastBlock();
(C) rd.getLastBlock(int lastBlock);
(D) rd.getLastBlock(lastBlock);

(11) What is the best way to describe an array?
(A) The elements of an array can be put in non-adjacent memory location.
(B) The elements of an array can be of different types.
(C) We can only create an array of primitive type.
(D) None of the above.

(12) Suppose we write move method as follows,

```
void move() {
    int index = rand() % length;
    position += pattern[index];
}
```

Suppose the current value of data member position is 10, and data member pattern is an array with values [-1, 0, 1, 2]. Suppose when we call move method, rand() returns 10. What is the value of position after this calling?
Note that length is a data member to record the number of elements of pattern.

(A) 9
(B) 10
(C) 11
(D) 12

(13) Suppose Dog class is inherited from Animal class. What is the proper head?

(A) class Dog

(B) class Dog : Animal

(C) class Animal : public Dog

(D) class Dog : public Animal

(14) When we define a class inherited from some class, what should we do?

(A) Define constructors.

(B) Define setters and getters for data members unique to subclass.

(C) Override methods that are inherited from superclass but behaves differently from subclass to superclass.

(D) all of the above

(15) What is the output of the following code?

```
int arr[] = {1, 2, 3, 4};
int* p = arr;
p += 3;
cout << *p << endl;
```

(A) 1

(B) 2

(C) 3

(D) 4

(16) Given the following code,

```
string message = "Hello";
char ch = message[1];
```

what is ch?

(A) Letter H

(B) Letter e

(C) Letter l

(D) Letter o

(17) How to release memory applied through in int* arr = new int[10]?

(A) arr = new int[10];

(B) delete[] arr;

(C) delete arr;
arr = nullptr;

(D) delete[] arr;
arr = nullptr;

(18) What is the output of the following code?

```
int m = 5;
int n = 6;
m = n;
n = m;
```

(A) Variable m is 5, n is 6.
(B) Variable m is 6, n is 5.
(C) Variable m is 5, n is 5.
(D) Variable m is 6, n is 6.

(19) What is the output of the following code?

```
double grade = 68.9;
switch ((int)grade/10)
{
        case 10:
        case 9:
        case 8:
        case 7:
        case 6:
                cout << "pass" << endl;
        default:
                cout << "fail" << endl;
 }
```

(A) pass
(B) fail
(C) pass
    fail
(D) compilation error

(20) What is correct about array in C++?

(A) int[] arr = {1, 2, 3};
(B) int arr[] = {1, 2, 3};
(C) int arr[3] = {1, 2.6, 3};
(D) Both (B) and (C)

3. (10 points, 5 point each) Answer the following short answer questions.

(1) Correct the errors, if any, in the code, which aims to swap two integers.

```
swap(int* m, int* n)
{
    int* temp = m;
    m = n;
    n = temp;
}

int main()
{
    int m = 5;
    int n = 6;
    swap(&m, &n);
    return 0;
}
```

(2) What is the output of the following code? Suppose proper libraries are included, name spaces are properly used, and function prototype is declared.

```
int main() {
    for (int n = 1; n <= 10; n++)
        if (foo(n))
            cout << n << endl;
}

bool foo(int n) {
    if (n == 1)
        return false;

    //n does not equal 1
    //check whether [2, sqrt(n)] has a factor of n.
    //Once we find the first factor in [2, sqrt(n)],
    //return false.
    for (int i = 2; i <= sqrt(n); i++)
        if (n % i == 0) //i is a factor of n
            return false;

    return true;
}
```

4. (5 points) **Define a method**, for a given array of strings, if every string in the array has at least 8 characters, then return true, otherwise (at least one string has fewer than 8 characters), return false.

5. (5 points) Define a two-dimensional array with 5 rows, the n-th row has n columns, where 1 <= n <= 5. The data of the array is as follows. Define and initialize the array, then print the array out as follows.

```
  0
  1  2
  3  4  5
  6  7  8  9
 10 11 12 13 14
```

6. (10 points) Define a class Triangle.

   Each Triangle has three edges, let us call it a, b, c, where the size of any two edges is larger than the third one. For simplicity, assume the edges are integers.

   (1) Declare class Triangle with data members and a constructor with three integer parameters.

   (2) Define a constructor to take three parameters, if the given parameters are all positive and sum of any two parameter is larger than the third one, then use them to initialize the corresponding data members, otherwise, set a, b, c to 1.

7. (10 points) Given Person class, extend it and define Doctor class.

Here are the signatures of the constructors and methods provided by Person class.

(1) Each person has a name (as a string) and age (as an int).
(2) Constructor Person() define name as "anonymous" and age as 18.
(3) Constructor Person(string name) uses given parameter name to initialized data member name, and initialize age as 18.
(4) Constructor Person(string name, int age) uses given parameter name to initialize data member age. If given parameter age is in the range of [0, 130], then uses given parameter age to initialize data member age, otherwise, set data member age to be 18.
(5) Method string getName() returns the name of a person.
(6) Method int getAge() returns the age of a person.
(7) Method void setAge(int age) uses given parameter age to reset data member age if the former is in the range of [0, 130], otherwise, leave the corresponding data member as it is.
(8) Method void setName(string name) uses given parameter name to reset data member name.

Each doctor is a person, just with additional data member to describe the name of all insurances he/she takes. This data member **insurances** can be a vector of string.

Your job: Declare Doctor class as a subclass of Person and define the following methods. NO NEED TO define Person class.

(1) Default constructor Doctor() with **insurances** initialized by "medicaid" and "medicare".
(2) Write a method, given a string representing a specific insurance, search whether it is in the vector of **insurances** or not, if yes, return true, otherwise, return false.