

CMPSC16 Midterm-II
Spring 2017
5/17/2017

This exam is closed book, closed notes. However, you may use one 8.5" x 11" piece of paper with notes on both sides. Write your name on the your notes paper. No calculators or phones are allowed in the exam. **Write all your answers on the answer sheet. However, all exam sheets, notes paper and scratch paper must be turned in at the end of the exam.**

By signing your name below, you are asserting that all work on this exam is yours alone, and that you will not provide any information to anyone else taking the exam. In addition, you are agreeing that you will not discuss any part of this exam with anyone who is not currently taking the exam in this room until after the exam has been returned to you. This includes posting any information about this exam on Piazza or any other social media. Discussing any aspect of this exam with anyone outside of this room constitutes a violation of the academic integrity agreement for CMPSC16.

Signature: _____

Name (please print clearly): _____

Umail address: _____@umail.ucsb.edu

Perm number: _____

You have 75 minutes to complete this exam. Work to maximize points. A hint for allocating your time: if a question is worth 10 points, spend no more than 5 minutes on it if a question is worth 20 points, spend no more than 10 minutes on it etc. If you don't know the answer to a problem, move on and come back later. Most importantly, stay calm. You can do this.

WRITE ALL YOUR ANSWERS IN THE PROVIDED ANSWER SHEET IN PEN!

DO NOT OPEN THIS EXAM UNTIL YOU ARE INSTRUCTED TO DO SO.

GOOD LUCK!

Part 1 [10 points] Multiple Choice: *Select the SINGLE best answer by filling in the circles provided in your answer sheet. You must shade your selection completely as shown below:*

☐ Not selected ☒ Selected

1. [2 pts] What is the output of the following C++ code if the file “myFile.txt” contains the words: “duck”, “cat”, “dog”, “mouse”, “horse”, with each word appearing on a separate line in the file. *SELECT THE SINGLE BEST ANSWER*

```
ifstream ifs;
ifs.open("myFile.txt");
string thisLine;
for(int i = 0; i < 2; i++){
    getline(ifs, thisLine);
    cout<<thisLine<< "  ";
}
```

- A. duck duck
- B. duck cat
- C. duck cat dog mouse horse
- D. The code will result in a segfault

2. [2 pts] What is the hex representation of the binary number 111001? *SELECT THE SINGLE BEST ANSWER*

- A. 0x71
- B. 0x39
- C. 0x57
- D. None of the above

3. [2 pts] What is the decimal representation of the hex number 0x2B? *SELECT THE SINGLE BEST ANSWER*

- A. 43
- B. 31
- C. 25
- D. None of the above

4. [2 pts] At what point in program execution is space allocated on the runtime stack to store the formal arguments of a function? *SELECT THE SINGLE BEST ANSWER*

- A. When the first line of main is executed
- B. When the program is compiled with g++
- C. When the function is called
- D. When the function returns

5.[2 pts] Consider the declaration of the array `'arr'` and the pointer `'p'`:

```
int arr[] = {10, 20, 40, 60};
int *p = arr;
arr[4] = 30;
```

Which of the following is most likely to happen when the above code is compiled and executed. Assume the code is embedded in a complete and otherwise correct C++ program. *SELECT THE SINGLE BEST ANSWER*

- A. The last element of the array is set to the value 30
- B. Compiler-time error
- C. Run-time error, specifically a seg-fault
- D. Either a seg-fault or a modification of data outside the boundaries of the array

Part 2 [50 pts]: Short answers and coding problems

1. [10 pts] Consider the following code and answer the questions below:

```
int arr[] = {10, 20, 40, 60};
int *p = arr;
```

- a. (2 pts) Draw a pointer diagram to show the content of memory when the above code is executed. Your diagram should be properly labeled.
- b. (1 pt) Write a line of code to set the first element in the array (currently 10), to the value 80.
- c. (2 pts) What is the output of the following code?

```
int result = 0;
for(int i = 0; i < 4; i++) {
    if((arr[i]%20)== 0){
        result+= arr[i];
    }
    cout<<arr[i]<< " ";
}
cout<<result<<endl;
```

- d. (5 pts) For the code provided below assume that the starting location of the array `'arr'` is `0x8000` and the location of the pointer `'p'` is `0x9000`. Write the output of each of the following C++ statements. Write your answer in hex or decimal notation.

```
int arr[]={10, 20, 40, 60};
int *p = arr;
```

- i. `cout<< arr+1;`
- ii. `cout<< *p;`
- iii. `cout<< *(p+2);`
- iv. `cout<< p[3];`
- v. `cout<< &p;`

2. [10 pts] Consider the following code:

```
char ch1 = 30, ch2 = 20, ch3 = 10;
char *ptr1 = &ch1, *ptr2 = 0;
char &r = ch2;
ptr2 = ptr1;
r = *ptr1 + ch3;
```

- (8 pts) Draw a pointer diagram to show the state of memory after the above code is executed.
- (2 pts) What is the size of each of these variables: **ch1** and **ptr1**

3. [20 pts] Imagine that you are writing a C++ program that provides information about aliens mentioned in Douglas Adam's novel series "Hitchhiker's guide to the galaxy". Your program uses the following struct definition:

```
struct Alien{
    string name;    // Name of the alien
    string planet;  // Planet that the alien lives on
    int IQ;         // Alien's intelligence quotient
    bool isFriendly; // True if alien is known to be friendly to
                   // earthlings, false otherwise
};
```

- (10 pts) Write a function named **getSmarterAlien()** that takes as input pointers to two Alien objects and returns the name of the alien with the higher IQ. If both aliens have the same IQ, the function should return the empty string. If either pointer has a null value, your function should print out an error message "Invalid pointer(s)" to `cerr` and exit.
- (10 pts) Implement the function **numFriendly()** that takes as input an array of type Alien, the number of elements in the array, and the name of a planet. The function should return the number of friendly aliens on that planet. The function should return 0 if there are no aliens on that planet or the length of the array is 0. For example: Suppose we declared an array of Aliens as follows:

```
Alien aliens[]={{"Bartledannians", "Bartledann", 100, false},
                {"Dentrassis", "Vogon", 90, true},
                {"Hoolooovoo", "Rupert", 230, true},
                {"Grebulons", "Rupert", 110, true},
                {"Hingefreel", "Vogon", 170, false}};
```

```
numFriendly(aliens, 5, "Bartledann") should return 0
numFriendly(aliens, 5, "Vogon")    should return 1
numFriendly(aliens, 5, "Rupert")   should return 2
numFriendly(aliens, 5, "Earth")    should return 0
```

Name: _____

Scratch Paper