CPSC 1070 – Programming Methodology, Prof. House

Sample Final Exam, 150 Minutes, Closed Book, Notes

These are example short answer questions. The final exam will have 10 short answer questions, each worth 4 points.

The following code contains a skeleton for a class `mystring` that is meant to handle standard C style strings (an array of `char` terminated by '`\0`'). Please answer the first 5 questions in relation to this code.

```
class mystring {
private:
  char *buf;
public:
  mystring() {
    std::cout << "default" << std::endl;
  }
  mystring(const char * s) {
    std::cout << "convert" << std::endl;
  }
  mystring(const mystring & s) {
    std::cout << "copy" << std::endl;
  }
  ~mystring() {
    std::cout << "destructor" << std::endl;
  }
  const char* getBuf() const { return buf; }
  mystring& operator=(const mystring& s) {
    std::cout << "assign" << std::endl;
    return *this;
  }
};

void dummy1(mystring z) {}
void dummy2(const mystring &z) {}

int main() {
  mystring x("cat");
  dummy1(x);
  dummy2(x);
}
```

1. What does the program print when run?

2. Write a definition for the default constructor for `mystring`.

3. Write a definition for the destructor for `mystring`.

4. Write a definition for the copy constructor for `mystring`.

5. Write a definition for the assignment operator for `mystring`.

6. Write the code to allocate space for a 2d array of `float` called `table` that has `nrows` rows, and `ncols` columns. The array should be capable of being indexed by row and column. For example to store 15.3 in row 2, column 4 you should be able to write `table[2][4] = 15.3;` Here is some code to get you started:

```
int nrows, ncols;
float **table;
. . .
table =
```

7. You are writing code for a project and planning to use C++ STL containers. One thing you have to keep track of is the progress of cars through segments of a production line. Another thing you have to keep track of is the placement of dashboard instruments, which use custom layouts and need to be assigned places based on customer instructions. Which STL containers would you use for each of the underlying data structures.

8. Rewrite the following `swap()` procedure using C++ templates so it can work with any data type, not just `int`.

```
void swap(int &n1, int &n2){
  int temp;
  temp = n1;
  n1 = n2;
  n2 = temp;
}
```

These are example long answer questions. The final exam will have three long answer questions, each worth 20 points.

9. Given the following declaration for a `Stack` class, where `table` is an array of size `tablesize`, write the definitions of the default constructor, and the `push()` and `pop()` methods for the class. Don't worry about any `#includes`. To explain further, `tablesize` should be initially set to 0 by the default constructor, but this should be modified by `push()`, which will allocate new space as needed to grow the size of `table`.

```
class Stack{
private:
  int top;
  int tablesize;
  float *table;
public:
  Stack();
  Stack(const Stack &s);
  void clear();
  bool empty() const;
  void push(float number);
  float pop();
  Stack& operator=(const Stack &s);
};
```

10. You are building a maze, which is organized as a 2D grid layout of a set of rooms. Each room can be either a wall, a corridor, a boss lair, an infirmary, or a treasure trove. Each room will be displayed with a different texture map, and each has a different effect on the player's movement. However, each room shares certain information, such as its location in the maze, and whether it has been entered before or not. Design a base class and subclasses for wall, boss, and treasure trove rooms.