COSC1076 | Advanced Programming Techniques

Revision Questions | Week 04

These are self-revision questions, to help you track if you are understanding the weekly course content.

You should FIRST answer these questions using "pen-and-paper". Only after this should you test your answers by writing and compiling programs.

1. Using the code snippet, answer the following questions

```
int value = -1;
int* ptr = &value;
int*& ptrRef = ptr;
*ptrRef = -5;
std::cout << *ptrRef << std::endl;
```

   (a) Explain the type of `ptrRef`
   (b) Draw a diagram to represent the state of memory for this code snippet
   (c) What will be the output of the code snippet? Explain your answer.
2. What are the two ways that a 1D array of characters may be represented?
3. What about a 2D array of characters?
4. It is not possible in C++ to create memory on the heap for a 2D array using a single `new` statement. Instead, multiple steps are required.
   (a) Write an algorithm for these steps
   (b) Write a C++ code snippet to allocate memory for a 2D array of characters on the heap
5. What is the purpose of a deconstructor for a C++ Class?
6. For a typical C++ program, which part of memory is automatically managed, and which part is programmer managed?
7. Using the file snippets, answer the following questions:

A.h

```
int foo();
```

B.h

```
#include "A.h"

int bar();
```

main.cpp

```
#include "A.h"
#include "B.h"

#define EXIT_SUCCESS    0

int main(void) {
    foo();
    bar();
    return EXIT_SUCCESS;
}
```

   (a) What is the problem in `main.cpp`?
   (b) Using a series of `#ifndef/#define/#endif` statements in `A.h` and `B.h` to fix the problem

8. Using the file snippets, answer the following questions:

Ownership.h

```
1  class Ownership {
2  public:
3      Ownership(int* ptr);
4      ~Ownership();
5
6  private:
7      int* ptr;
8  };
```

Ownership.cpp

```
1  #include "Ownership.h"
2
3  Ownership::Ownership(int* ptr) {
4      this->ptr = ptr;
5  }
6
7  Ownership::~Ownership() {
8  }
```

main.cpp

```
1  #include "Ownership.h"
2
3  #define EXIT_SUCCESS    0
4
5  int main(void) {
6      int* ptr = new int(-1);
7      Ownership* owner = new Ownership(ptr);
8
9      delete ptr;
10     delete owner;
11
12     return EXIT_SUCCESS;
13 }
```

These questions are about which part of the code is the owner of the memory that has been allocated for the integer in line 6 of `main.cpp`.

(a) Where is the memory for the integer allocated?

(b) As written, which part of the code is currently the owner of the memory for the integer? Explain your answer.

(c) If the ownership of the integer should be *transfered* to the `Ownership` class, modify the above code to ensure the ownership is correctly transferred, and ensure that the memory for the integer is correctly managed.

9. For the files in Question 8, write the compilation commands if partial compilation is used to compile each code file individually.