Tutorial 1 – C/C++ Primer

I - Required

Question 1: What is the output of the following code? Explain your answer.

```
char str[5] = "ABC";
cout << str[3];
cout << str;
```

(a) A
(b) AB
(c) ABC
(d) Compile time error

Answer: Choice (c)

Question 2: What is the output of the following code? Explain your answer.

```
int a = 5, b = 10, c = 15;
int *arr[3] = {&a, &b, &c};
cout << *arr[*arr[1] - 9];
```

(a) 5
(b) 10
(c) Garbage value
(d) Compile time error

Answer: Choice (b)

Question 3: What is the difference between struct and class in C++?

Answer: Members of a class are private by default and members of struct are public by default. When deriving a struct from a class/struct, default access-specifier for a base class/struct is public and when deriving a class, default access specifier is private.

Question 4:

(a) Declare a dynamic array of pointers (to integers) of size 10?
(b) What happens when **delete** is use with a NULL pointer? What if we call **delete** twice on the same pointer?

Answer:
(a) int **p = new int*[10];
(b) Call delete twice on the same pointer yields an undefined behavior, the program might crash or nothing happen.

Question 5: Consider the following recursive function fun(x, y). What is the value of fun(3, 2) ? List the recursive function calls.

```
int fun(int x, int y) {
  if (x == 0)
    return y;
  return fun(x - 1,  x + y);
}
```

Answer: 8

```
fun(3,2) -> fun(2,5) -> fun(1,7) -> fun(0,8) -> 8
```

II – Advanced (required for honor classes)

Question 1: "For" loops can always be re-written as "while" loops, and vice-versa. Are the following two codes equivalent, and what is their output? Explain your answer, and run the codes to check.

(a)

```
int count = 1;
for (; count <= 5 ; count++)
{
    int count = 1;
    cout << count << "\n";
}
return 0;
```

(b)

```
int count = 1;
while (count <= 5)
{
    int count = 1;
    cout << count << "\n";
    count++;
}
return 0;
```

Answer:

(a) This program exits after printing five '1' to the screen.

(b) This program never finishes and countinue printing '1' to the screen.

Question 2: Given int x = 0 and the following functions:

```
void f(int x) {
    x++;
    return;
}
```

```
void g(int &x) {
    x++;
    return;
}
void h(const int &x) {
    x++;
    return;
}
```

What is the value of x after each function call f(x), g(x) and h(x)?

Answer:

- The value of x after call to f(x) is unchanged, thus x remains 0
- The value of x after call to g(x) is increased, since x is passed into g(x) by reference.
- The function call h(x) yields an error because const pointer cannot be modified.

Question 3: What is the output of the following program? Correct the program if there is any compile time error.

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

  class Test {
    int x;
    Test() { x = 5;}
  };

  int main() {
     Test *t = new Test;
     cout << t->x;
  }
```

Answer: There is a compile time error. Because by default, attribute x of class Test has private access.

Question 4: What is the value of q[2] and p[1][2] after each call to **delete**?

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

int main() {
    int **p = new int*[5];
    int *q = new int[5];
    for (int i = 0; i < 5; i++) {
        q[i] = i;
    }
    p[1] = q;
```

```
        delete p;
        delete q;
        delete [] q;
    }
```

Answer:

- After `delete p`, q[2] remains 2, access to p[1][2] yields undefined behavior (Result depends on how operating system handle memory access, may cause segfault or allow access variable normally)
- After `delete q`, access to both q[2] p[1][2] yields undefined behavior
- `delete [] q` caused a runtime error

Question 5: Given int x = 15, and the following recursive function fun(n, &ptr) . What is the value of fun(5, &x) ?

```
int fun(int n, int *f_p) {
        int t, f;
        if (n <= 1)
        {
            *f_p = 1;
            return 1;
        }
        t = fun(n- 1,f_p);
        f = t+ * f_p;
        *f_p = t;
        return f;
    }
```

Answer: 8