

# Tutorial 1 – C++ Primer

- C++ review
- Complexity
- Recursion

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## Problem 1

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What is the output of the following code?

```
char str[12] = "123\0";  
cout << (int) str[5] << str[6];
```

Explain the result. Will the output be the same for both g++ (Linux) and cl (visual studio)?

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## Problem 2

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Given the following block of codes:

```
int a = 2, b = 3, c = 4;  
int *arr[3] = {&a, &b, &c};  
cout << *arr[arr[2][0]-*arr[1]];
```

What is the output? Explain the result.

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## Problem 3

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- Declare a dynamic array of size 20.
- Given a pointer \*ptr, what is the difference between `delete [] ptr` and `delete ptr`?
- Can a NULL pointer be deleted?

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## Problem 4

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Given the following function:

```
int fun(int n) {  
    if (n <= 2) return n;  
    int tmp = n;  
    for (int i = 2; i*i <= n; i++) {  
        if (n % i == 0) {  
            tmp = 0;  
            break;  
        }  
    }  
    return tmp + fun(n - 1);  
}
```

```
}
```

- a) What is the output of `fun(24)`? Write the last 5 function calls.
- b) What does this function do?

## Problem 5

Convert the following codes into a while loop:

```
int x;  
cin >> x;  
x /= 3;  
for (; x != 0; x /= 3)  
{  
    if (x % 3 == 0) return true;  
}  
return false;
```

## Problem 6

Given the following functions:

```
void f(int *x) {  
    int a = 4;  
    x = &a;  
}  
  
void g(int *&x) {  
    int a = 3;  
    x = &a;  
}  
  
void h(const int *&x) {  
    int b = 2;  
    x = &b;  
}  
  
int main() {  
    int *p = new int;  
    *p = 5;  
    f(p);  
    cout << p << " " << *p << endl; // Print #1  
    g(p);  
    cout << p << " " << *p << endl; // Print #2  
    cout << p << " " << *p << endl; // Print #3  
    const int*p1 = p;  
    h(p1);  
    cout << p << " " << *p << endl; // Print #4  
    cout << p << " " << *p << endl; // Print #5  
    cin >> *p;  
}
```

What are the outputs of Print #1 to #5? Explain the results. If possible, run the above codes using g++/Linux to see the difference from Visual Studio.

## Problem 7

What is the outputs of the following program?

```
#include <iostream>
using namespace std;
class Test {
    int x;
    Test() { x = 5; }
};
int main() {
    Test *t = new Test();
    cout << t->x;
}
```

If there is any error, fix it so that it can work.

## Problem 8

Given the following block of codes:

```
int **p = new int*[5];
int *q = new int[5];
for (int i = 0; i < 5; i++) {
    q[i] = i;
}
p[3] = q;
delete p;
delete q;
delete[] q;
```

What are the values of p[3][3] and q[3] after each `delete` call? (Hint: use debug tool).

## Problem 9

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 = *f_p/2;
        return *f_p;
    }
    t = fun(n - 1, f_p);
    f = t + *f_p;
    *f_p = t;
    return f;
}
```



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```
}
```