P1) Consider the following program.

a. What is the purpose of the program?

create an instance of class MyClass and write the char 'a' to position n in the member char array. n is received from user input.

b. What is the main programming error in the program? we never allocate memory for c.

c. Add code in order to fix the programming error.

```
#include <iostream>

using namespace std;

class MyClass{
    private:
        char *c; ←          MyClass(const int & n);
    public:
        ~~MyClass()~~; ← constructor
        char& Put(const int &n);
        char& Get(const int &n);
        ~MyClass();
 };

~~MyClass::MyClass(){~~
~~};~~

char& MyClass::Put(const int& n){
    return c[n];
};

char& MyClass::Get(const int& n){
    return c[n];
};

void MyFn(MyClass& m1){
    MyClass *mc;
    mc = ~~new MyClass;~~ new MyClass(10);
    mc->Put(3) = 'a'; ←
    m1.Put(3) = mc->Get(3);
};

int main()
{
    int n;
    ~~MyClass m1~~; MyClass m1(20);

    cin >> n;
    MyFn(m1);
    cout << m1.Get(3);

    return 0;
};
```

```
MyClass::MyClass(const int & n){
    c = new char[n];
}

MyClass::~MyClass(){
    delete c;
}
```

P2) We consider the `class Z` which is defined as shown below.

```
#include <iostream>

using namespace std;

class Z
{
    private:
        int *z1; int *z2;
    public:
        Z(const int x1 = 0, const int x2 = 0);
        Z(const Z &X);
        int *first (void) const {return z1;};
        int *second (void) const {return z2;};
        ~Z(void);
};
```

Here, the constructor is supposed to store the values `x1` and `x2` by using the members of the class and the copy constructor is supposed to copy the content of another object into the constructed instance of `class Z`.

a. Implement the constructor and the copy constructor of the class.

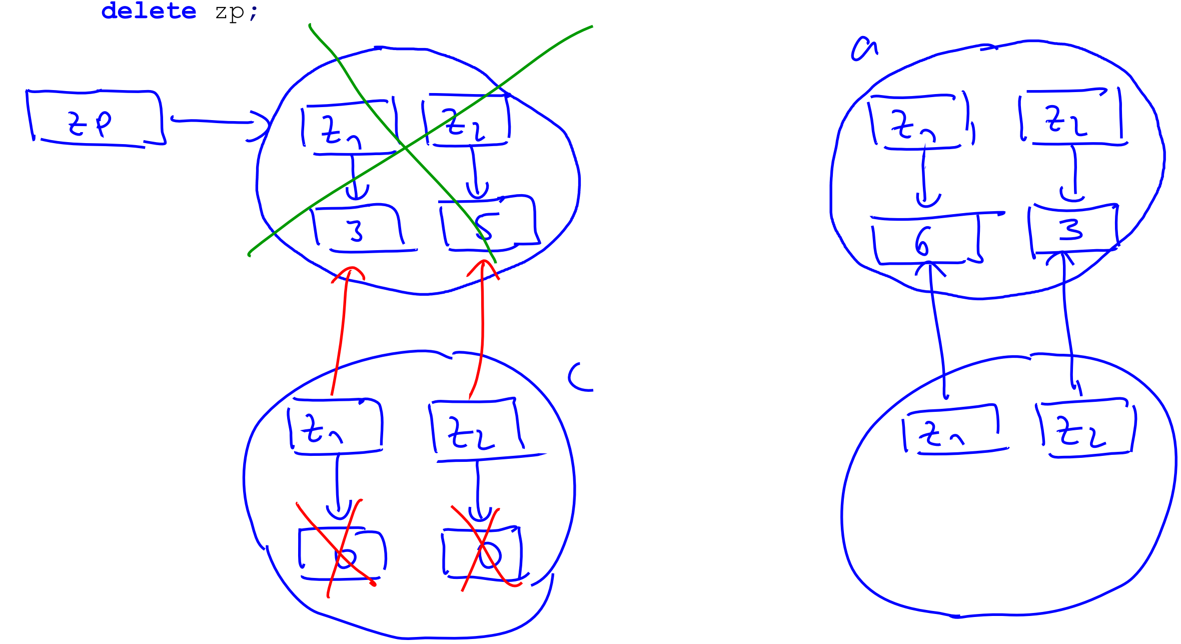
```
Z::Z(const int x1, const int x2){
        z1 = new int(x1);
        z2 = new int(x2);
}

Z::Z(const Z &X){
        z1 = X.first();
        z2 = X.second();
}
```

b. Implement the destructor of the class.

```
Z::~Z(void){
        delete z1;
        delete z2;
}
```

c. Based on your implementation of this class, draw the constructed data structures after the following program sequence is executed in the main function:

```
Z *zp;
zp = new Z(3,5);
Z a(6, *(zp->first() ) ), b=a, c(0,0);
c = *zp;
delete zp;
```



d. What do you expect when accessing c after running the above program sequence?

~> see the explanation in the video

=> memory error since the memory pointed to by the members of c is freed.

e. How can you modify the copy constructor in order to avoid the observed problem?

~> see the modification done in the program code.