Question 1 [10 Marks]

a) What would be the output produced by executing the following C++ code? Identify errors, if any (Either write output or error , Both will not be acceptable). (6 marks)

```
1#include <iostream>
2 using namespace std;
3 class Number {
4 private:
5 int n;
6 public:
7 Number() : n(0) {
8 cout << n;
9 }
10
11 Number( int nn )
12 : n(nn)
13 {
14 cout << n;
15 }
16
17 Number(Number const& otherNum)
18 : n(otherNum.n+1)
19 {
20 cout << n;
21 }
22
23 void display() { cout << n; }
24 void increase() { n += 1; }
25 };
26 int main(){
27 Number a, b(1), c(b);
28 b.increase();
29 c.display();
30 b.display();
Return 0;
31 }
```

0
~~1~~1
1
1
2

b) What would be the output produced by executing the following C++ code? Identify errors, if any (Either write output or error, both will not be acceptable). (6 marks)

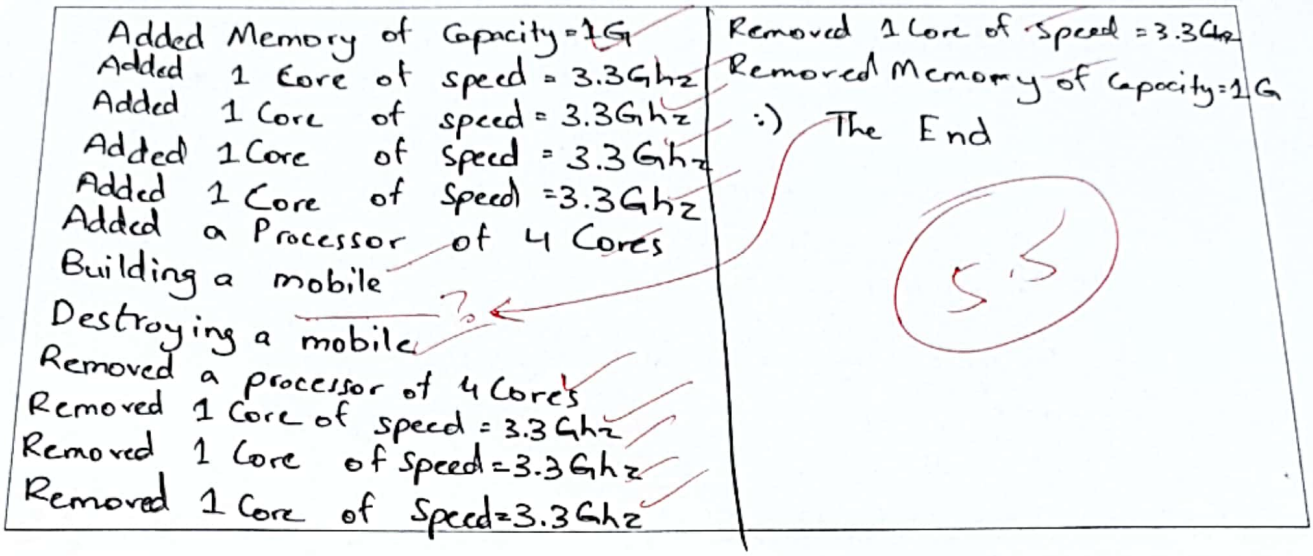
```
1 #include <iostream>
2 using namespace std;
3 class Test{
4 private:
5 int val;
6 public:
7 Test(const Test& _other) : val(_other.val + 1)
8 { }
9
10 Test(int _val) : val(_val) { }
11
12 int get_val() const{ return val;}
13
14 const Test& operator=(Test const& _other){
15 val = _other.val;
16 return *this;
17 }
18 Test operator+(Test const& _other){
19 Test t(val+ _other.val);
20 return t;
21 }
22 };
23
24 ostream& operator<<(ostream& stream, const Test & _val){
25 stream << _val.get_val();
26 return stream;
27 }
28
29 int main( ){
30 Test a(1), b(2),c(a+b);
31 a = b+c;
32 cout << a << " " << b<<" "<<c;
Return 0;
33 }
```

10 4 6

Zero

c) What would be the output produced by executing the following C++ code? Identify errors, if any (Either write output or error, both will not be acceptable). (6 marks)

```
#include <iostream>
using namespace std;
class Memory {
float capacity;
public:
Memory(int cap = 1) {
capacity = cap;
cout << " Added Memory of Capacity= "
<< capacity << " G " << endl;
}
~Memory() {
cout << " Removed Memory of Capacity= "
<< capacity << " G " << endl;
}
};
class Core {
float speed;
public:
Core(float speed_ = 3.3) {
speed = speed_;
cout << " Added 1 Core of Speed= "
<< speed << " GHz " << endl;
}
~Core() {
cout << " Removed 1 Core of Speed= "
<< speed << " GHz " << endl;
}
};
class Processor {
const int ncores;
Core cores[4];
public:
Processor() :
ncores(4) {
cout << " Added a Processor of "
<< ncores << " Cores " << endl;
}
~Processor() {
cout << " Removed a Processor of = "
<< ncores << " cores " << endl;
}
};
class Mobile {
Memory m;
Processor p;
public:
Mobile() {
cout << " Building a Mobile " << endl;
}
~Mobile() {
cout << " Destroying a Mobile " << endl;
}
};
int main() {
Mobile m;  cout << " :) The End " << endl; return 0; }
```



d) What would be the output produced by executing the following C++ code? Identify errors, if any (Either write output or error, both will not be acceptable). (6 marks)

```
1 #include <iostream>
2 #include<cassert>
3 using namespace std;
4 class Point3D
5 {
6 public:
7 Point3D() {
8 p[0] = p[1] = p[2] = 0;
9 }
10 Point3D(int x_, int y_, int z_) {
11 p[0] = x_; p[1] = y_; p[2] = z_;
12 }
13 Point3D operator*(const int & v) {
14 Point3D v1;
15 v1[0] = p[0] + v; v1[1] = p[1] + v; v1[2] = p[2] + v;
16 return v1;
17 }
18
19 Point3D operator+(const Point3D &v) {
20 Point3D v1;
21 v1[0] = p[0] + v[0]; v1[1] = p[1] + v[1]; v1[2] = p[2] + v[2];
22 return v1;
23 }
24
25 Point3D operator-(const Point3D &v) {
26 Point3D v1;
27 v1[0] = p[0] - v[0]; v1[1] = p[1] - v[1]; v1[2] = p[2] - v[2];
28 return v1;
29 }
30
31 Point3D operator-() {
32 Point3D v1;
```

```
33 v1[0] = -p[0]; v1[1] = -p[1]; v1[2] = -p[2];
34 return v1;
35 }
36 bool operator==(const Point3D &v) {
37 return p[0] == v[0] && p[1] == v[1] && p[2] == v[2];
38 }
39 int operator[](const int & i) const {
40 assert(i >= 0 && i <= 2); // check for index with-in range
41 return p[i];
42 }
43 int & operator[](const int & i) {
44 assert(i >= 0 && i <= 2); // check for index with-in range
45 return p[i];
46 }
47 private:
48 int p[3];
49 };
50 ostream &operator<<(ostream &out, const Point3D&v) {
51 out << " X = " << v[0] << " Y = " << v[1] << " Z = " << v[2] <<
endl
52 << flush;
53 return out;
54 }
55
56 int main() {
57 Point3D p1(10, 20, 30), p2(20, 30, 40);
58 cout << " P1 : " << p1 << " P2 : " << p2 << endl;
59
60 Point3D p3;
61 p3[0] = 5;
62 p3[1] = 5;
63 p3[2] = 5;
64
65 Point3D p4 = -p1 - p2 - p1 * !(p1 == p2);
66 cout << " P4 : " << p4 << endl; return 0; }
```

e) What would be the output produced by executing the following C++ code? Identify errors, if any (Either write output or error, both will not be acceptable). (5 marks)

```
#include <iostream>
#include <cassert>
using namespace std;
class Number {
public:
static int n;
Number() {cout << n++<<endl; }

Number(int i) {n=i;cout << n<<endl;}
static void somefunc(){  n=5;}

Number(Number const& otherNum){  cout << n<<endl; }

~Number(){cout<<--n;}
};

void fun(Number n){
     cout<<n.n<<endl;
     n.somefunc();
}
int Number::n=0;

int main(){
Number a, b(9), c(a);
fun(b);

return 0;
}
```

Error No default value given.

f) What would be the output produced by executing the following C++ code? Identify errors, if any (Either write output or error, both will not be acceptable). (6 marks)

```
#include <iostream>
using namespace std;
class Integer {

private: int *n;

public:
  Integer() : n(new int) { *n=5;}

  Integer( int nn ):n(new int){  *n=nn;   cout << *n<<" ";  }

  Integer(Integer const& otherNum): n(otherNum.n){  cout << *n<<" ";  *n+=4;     }

  void display() { cout << *n<<" "; }

  void increase() { *n += 1; } };

int main(){

      Integer a, b(1), c(b);

      b.increase();

      c.display();

      b.display(); return 0; }
```

1 2

2

Question 2 [3+5+2+5+5+5 Marks]

Your goal is to write a program for creating a Phonebook. Your Phonebook should allow for storage of many contacts, where each contact should be represented by a person name and his phone number. In addition, to basic functionality your Phonebook should allow facility of performing following operations:
Implement two classes Phonebook and Contact, identify the relationship between them and implement the given operators.

1. Implement two classes Phonebook and Contact, identify the relationship between them and implement the given operators.
2. Write Necessary Constructors and Destructors for the classes.
3. Write All Necessary functions to implement the following Functionalities and relation.
4. The union of two Phonebooks (Should be done by overloading + Operator)
5. The direct access of a contact's phone number via name (overloading the operator []). User should be able to both read and write the phone number via this operator.
6. Printing and Input of a contact using stream insertion and extraction operators.

Note: You are not required to write the main function. Apply all necessary OOP concepts.

```
Class Contact{
    string name;
    int number;
Public:
    string(){ name = "ABC"};
    ~string();
    number(){ number = 321321};
    ~number();
};
Class Phonebook{
    Contact C;
Public:
    Phonebook()
```