Constructor and destructors

Today’s Agenda

Today we are going to cover -

- Constructor
- Types of Constructor
- Default Constructor
- Parameterized Constructor
- Copy Constructor
- Practice Question
- Initializer List
- Constructor with default argument
- Destructor

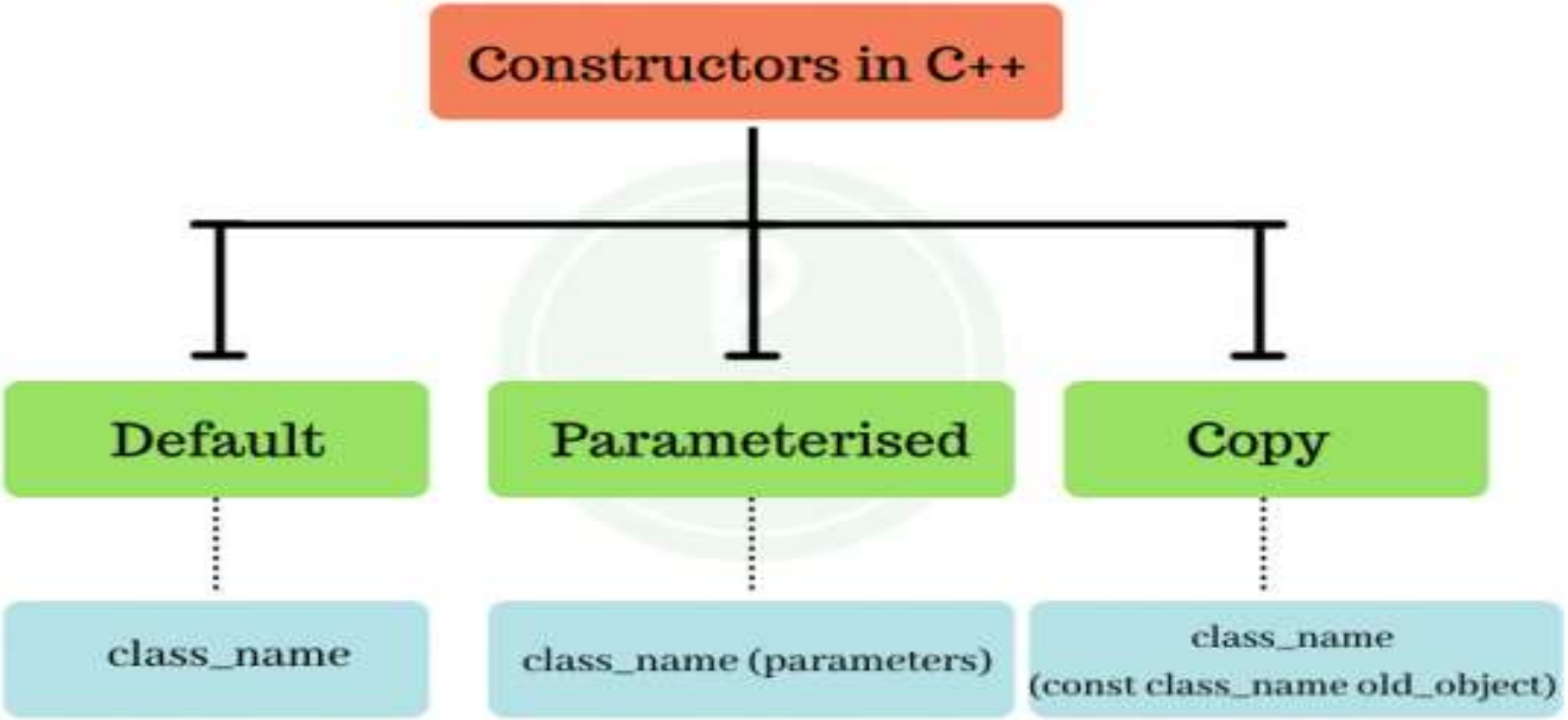
Let’s Get Started-

Constructor

A constructor is a member function of a class which initializes objects of a class. In C++, Constructor is automatically called when object(instance of class) create. It is special member function of the class.

- Constructor has same name as the class itself
- Constructors don’t have return type
- A constructor is automatically called when an object is created.
- If we do not specify a constructor, C++ compiler generates a default constructor for us (expects no parameters and has an empty body).

Types of constructor



Default Constructor

1. Default Constructors: Default constructor is the constructor which doesn't take any argument. It has no parameters.

```
class construct
{
public:
    int a, b;

    // Default Constructor
    construct()
    {
        a = 10;
        b = 20;
    }
};
```

Default Constructor

```
int main()
{
   // Default constructor called automatically
   // when the object is created
   construct c;
   cout << "a: " << c.a << endl
      << "b: " << c.b;
   return 1;
}
```

Output

a: 10

b: 20

Even if we do not define any constructor explicitly, the compiler will automatically provide a default constructor implicitly.

Parameterized Constructors

It is possible to pass arguments to constructors. Typically, these arguments help initialize an object when it is created. To create a parameterized constructor, simply add parameters to it the way you would to any other function. When you define the constructor's body, use the parameters to initialize the object.

Parameterized Constructors

```
class Point
{
private:
    int x, y;

public:
    // Parameterized Constructor
    Point(int x1, int y1)
    {
        x = x1;
        y = y1;
    }
```

Parameterized Constructors

```
int getX()
    {
        return x;
    }
    int getY()
    {
        return y;
    }  };
int main()
{
    // Constructor called
    Point p1(10, 15);
    cout << "p1.x = " << p1.getX() << ", p1.y = " << p1.getY();
    return 0;
}
```

Parameterized Constructors

p1.x = 10, p1.y = 15

When an object is declared in a parameterized constructor, the initial values have to be passed as arguments to the constructor function. The normal way of object declaration may not work. The constructors can be called explicitly or implicitly.

Example e = Example(0, 50); // Explicit call

Example e(0, 50); // Implicit call

We can have more than one constructor in a class it is called constructor overloading.

Uses of Parameterized Constructor

- It is used to initialize the various data elements of different objects with different values when they are created.

- It is used to overload constructors.

Copy Constructor

Copy Constructor: A copy constructor is a member function which initializes an object using another object of the same class.

Whenever we define one or more non-default constructors(with parameters) for a class, a default constructor(without parameters) should also be explicitly defined as the compiler will not provide a default constructor in this case. However, it is not necessary but it’s considered to be the best practice to always define a default constructor.

Copy Constructor

```
class point
{
private:
double x, y;

public:

// Non-default Constructor &
// default Constructor
point (double px, double py)
{
    x = px, y = py;
}
};
```

Copy Contstructor

```
int main(void)
{

// Define an array of size
// 10 & of type point
// This line will cause error
point a[10];

// Remove above line and program
// will compile without error
point b = point(5, 6);
}
```

Output

Error: point (double px, double py): expects 2 arguments, 0 provided

MCQ 1

Which of the followings is/are automatically added to every class, if we do not write our own.

(A) Copy Constructor

(B) Assignment Operator

(C) A constructor without any parameter

(D) All of the above

MCQ 1

Which of the followings is/are automatically added to every class, if we do not write our own.

(A) Copy Constructor

(B) Assignment Operator

(C) A constructor without any parameter

(D) All of the above

MCQ 2

```
#include<iostream>
using namespace std;
class Point {
    Point() { cout << "Constructor called"; }
};

int main()
{
Point t1;
return 0;
}
```

(A) Compiler Error
(B) Runtime Error
(C) Constructor called

MCQ 2

```
#include<iostream>
using namespace std;
class Point {
    Point() { cout << "Constructor called"; }
};

int main()
{
Point t1;
return 0;
}
```

(A) Compiler Error

(B) Runtime Error

(C) Constructor called

Guess the output 1

```
class A{
   int a;
public:
    A(){
        cout<<"D\n";
    }
    A( A &a){
        cout<<"C\n";
    }
};
int main(int argc, char const *argv[])
{
    A obj;
    A a1 = obj;
    A a2(obj);
}
```

Guess the output 1

Default constructor called
Copy Constructor called
Copy Constructor called

Guess the output 2

```
class A{
   int a;
public:
   A(){
      cout<<"A's default constructor called\n"; //@
   }
   A(const A& a){
      cout<<"A's copy Constructor called\n"; //#
   }
};
class B{
   A obj;
public:
   B(){
      cout<<"B's Constructor called\n"; // $
   }
};
```

Guess the output 2

```
int main()
{
    B b1;
    B b2;
}
```

Guess the output 2

A's default constructor called

B's Constructor called

A's default constructor called

B's Constructor called

Initializer List

Initializer List is used in initializing the data members of a class. The list of members to be initialized is indicated with constructor as a comma-separated list followed by a colon. Following is an example that uses the initializer list to initialize x and y of Point class.

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

class Point {
private:
    int x;
    int y;
public:
```

Initializer List

```
Point(int i = 0, int j = 0):x(i), y(j) {}
   /* The above use of Initializer list is optional as the
      constructor can also be written as:
      Point(int i = 0, int j = 0) {
         x = i;
         y = j;
      }
   */

   int getX() const {return x;}
   int getY() const {return y;}
};
```

Initializer List

```
int main() {
Point t1(10, 15);
cout<<"x = "<<t1.getX()<<", ";
cout<<"y = "<<t1.getY();
return 0;
}
```

OUTPUT:

x = 10, y = 15

Default Argument

A default argument is a value provided in a function declaration that is automatically assigned by the compiler if the caller of the function doesn't provide a value for the argument with a default value.

```
// A function with default arguments, it can be called with
// 2 arguments or 3 arguments or 4 arguments.
int sum(int x, int y, int z=0, int w=0)
{
    return (x + y + z + w);
}
```

Default Argument

```
/* Driver program to test above function*/
int main()
{
   cout << sum(10, 15) << endl;
   cout << sum(10, 15, 25) << endl;
   cout << sum(10, 15, 25, 30) << endl;
   return 0;
}
```

Output

```
25
50
80
```

Destructors

Destructor is a member function which destructs or deletes an object.

Syntax:-

~constructor-name();

Properties of Destructors

- Destructor function is automatically invoked when the objects are destroyed.
- It cannot be declared static or const.
- The destructor does not have arguments.
- It has no return type not even void.
- A destructor should be declared in the public section of the class.
  (A destructor can be private but for specific advance cases)
- The programmer cannot access the address of destructor.

When a Destructors is called

A destructor function is called automatically when the object goes out of scope:

- the function ends
- the program ends
- a block containing local variables ends
- a delete operator is called

Can there be more than one destructor in a class?

No, there can only one destructor in a class with classname preceded by ~, no parameters and no return type.

MCQ 1

Can destructors be private in C++?

(A) Yes

(B) No

MCQ 1

Can destuctors be private in C++?

(A) Yes

(B) No

MCQ 2

Like constructors, can there be more than one destructors in a class?

(A) Yes

(B) No

MCQ 2

Like constructors, can there be more than one destructors in a class?

(A) Yes

(B) No

Guess the output 1

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

int i;

class A
{
public:
   ~A()
   {
      i=10;
   }
};
```

Guess the output 1

```
int foo()
{
    i=3;
    A ob;
    return i;
}

int main()
{
    cout << foo() << endl;
    return 0;
}
```

Guess the output 1

3

Guess the output 2

```
class A
{
    int id;
    static int count;
public:
    A() {
        count++;
        id = count;
        cout << "constructor for id " << id << endl;
    }
    ~A() {
        cout << "destructor for id " << id << endl;
    }
};
```

Guess the output 2

```
int A::count = 0;

int main() {
    A a[3];
    return 0;
}
```

Guess the output 2

constructor for id 1

constructor for id 2

constructor for id 3

destructor for id 3

destructor for id 2

destructor for id 1

QNA Time

Any Questions??

Thank You!

See you guys in next class.