Digital Design Verification

Assignment # 03

Constructor in C++

Catching Bugs in C++

Submitted by:

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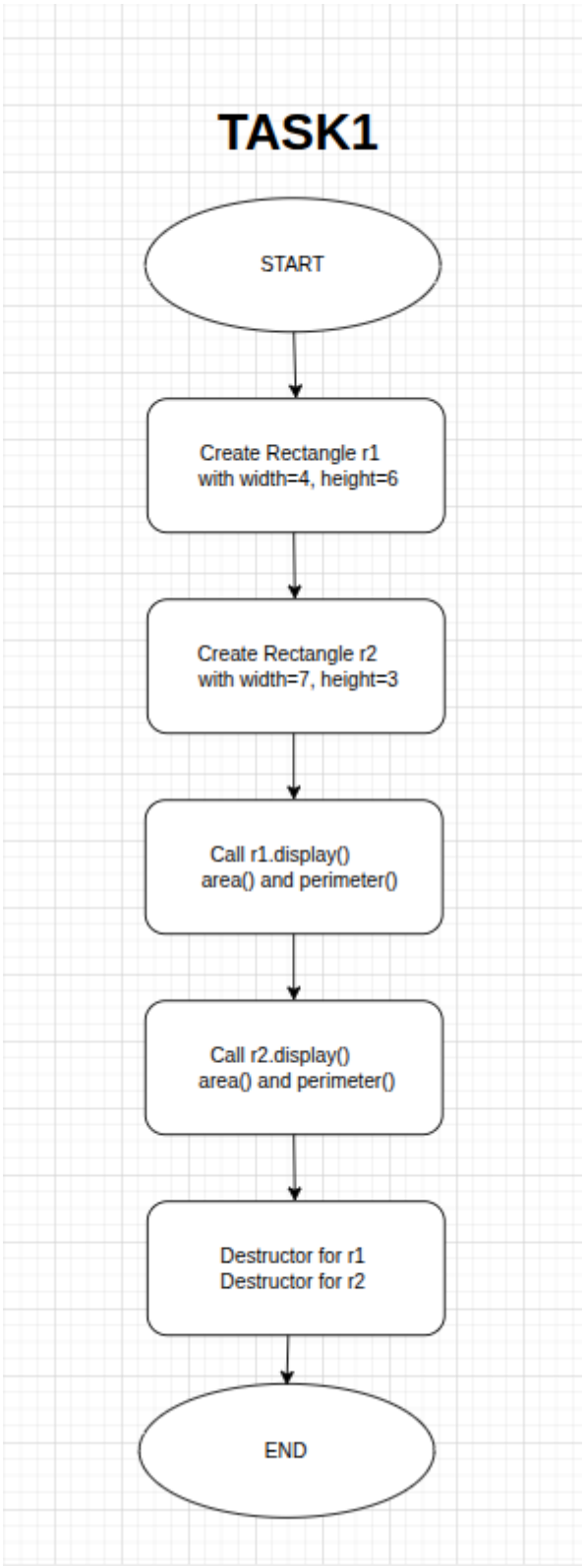
TASK # 01:

Flow Chart:



TERMINAL OUTPUT:

```
PROBLEMS  OUTPUT  TERMINAL  PORTS
TERMINAL
khalilrehman@khalilrehman-ThinkPad-T14-Gen-1:~/Documents/C++/Assignment#03$ g++ task1.cpp -o task1
khalilrehman@khalilrehman-ThinkPad-T14-Gen-1:~/Documents/C++/Assignment#03$ ./task1
Constructor called. Rectangle created
Constructor called. Rectangle created
Width: 4, Height 6
Area 24, Parameter: 20
------------------------
Width: 7, Height 3
Area 21, Parameter: 20
------------------------
Destructor called. Deleting Rectangle
Destructor called. Deleting Rectangle
khalilrehman@khalilrehman-ThinkPad-T14-Gen-1:~/Documents/C++/Assignment#03$
```

TASK#02

1.

- `myPoint declared` as `const`, which means it cannot be modified. But `doubleVal()` modifies the member variables `x` and `y`, which violates the `const`.

Code

ome > khalilrehman > Documents > C++ > Assignment#03 > task2.cpp > ...

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


//#1
class Point {
private:
    int x, y;

public:
    Point(int u, int v) : x(u), y(v) {}
    int getX() const { return x; }
    int getY() const { return y; }
    void doubleVal() {
        x *= 2;
        y *= 2;
    }
};

int main() {

    //const Point myPoint(5, 3);
    //myPoint.doubleVal();

    Point myPoint(5, 3);
    myPoint.doubleVal();
    cout << myPoint.getX() << " " << myPoint.getY() << "\n";
    return 0;
}
```

2.

- The method `setX()` is marked `const`, which means it cannot change any class member variables.

Code

```
32
33  #include <iostream>
34  using namespace std;
35
36  class Point {
37  private:
38      int x, y;
39
40  public:
41      Point(int u, int v) : x(u), y(v) {}
42      int getX() const { return x; }
43      int getY() const { return y; }
44   //   void setX(int newX) const { x = newX; }
45      void setX(int newX) { x = newX; }
46  };
47
48  int main() {
49      Point p(5, 3);
50      p.setX(9001);
51      cout << p.getX() << ' ' << p.getY();
52      return 0;
53  }
54
55
```

3.

- x and y are declared `private:` in the `Point` class. Private members cannot be accessed directly outside the class to access them directly in `main()`, which causes a compilation error.

```
56
57  //cout << p.x << " " << p.y << "\n";
58
59
60  #include <iostream>
61  using namespace std;
62
63  class Point {
64  private:
65      int x, y;
66
67  public:
68      Point(int u, int v) : x(u), y(v) {}
69      int getX() { return x; }
70      int getY() { return y; }
71  };
72
73  int main() {
74      Point p(5, 3);
75      cout << p.getX() << " " << p.getY() << "\n";  //Corrected line
76      return 0;
77  }
78
```

4

- Line 10: Redundant declaration of `setX()` with no body.
- Line 13: Valid definition of `setX()` is placed after the class is already closed.

```
79
80  //4
81  #include <iostream>
82  using namespace std;
83
84  class Point {
85  private:
86      int x, y;
87
88  public:
89      Point(int u, int v) : x(u), y(v) {}
90      int getX() { return x; }
91
92      void setX(int newX) {  //Move inside class and define once
93          x = newX;
94      }
95  };
96
97  int main() {
98      Point p(5, 3);
99      p.setX(0);  // Now allowed
100     cout << p.getX() << " " << "\n";
101     return 0;
102 }
```

5

- `new int[size]` dynamically allocates an array.
- must use `delete[]` to correctly free the memory which causes undefined behavior and a memory leak.

```
104
105  //5
106
107  int size;
108  cin >> size;
109
110  int* nums = new int[size];
111  for (int i = 0; i < size; ++i) {
112      cin >> nums[i];
113  }
114
115  // ... // Calculations with nums
116
117  delete[] nums;  //Correctly deallocates dynamic array
```

6

- `new Point(...)` allocates memory on the heap. But `delete p;` is missing which causes a memory leak especially in larger programs.

```
120  //6
121  #include <iostream>
122  using namespace std;
123
124  class Point {
125  private:
126      int x, y;
127
128  public:
129      Point(int u, int v) : x(u), y(v) {}
130      int getX() { return x; }
131      int getY() { return y; }
132  };
133
134  int main() {
135      Point* p = new Point(5, 3);
136      cout << p->getX() << ' ' << p->getY() << endl;
137
138      delete p;  //Prevent memory leak
139      return 0;
140  }
```