

Mini project report

Subject: OOP&CG

Class: SE-4

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Batch: F4

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Title of the mini project:

Logic Gates Simulator

Problem statement:

Design and implement game/ animation clip/ simulator/ graphics editor using open source graphics library. Make use of maximum features of object oriented programming.

Learning objective:

To make use of object oriented programming features or concepts to design a game or simulator or animation clip.

Learning outcomes:

Implementation of logic gates simulator using c++ program using Qt creator to verify the truth tables of logic gates and combinational circuits.

Software requirements:

1) Windows operating system

2) Qt creator

Hardware requirements:

- 1) Monitor for displaying
- 2) CPU

Theory:

Logic gates:

Logic gates are the basic building blocks of any digital system. It is a system having one or more than one input and only one output. The relationship between input and output is based on some of the logic known as the logical expression.

Basic gates:

1) AND gate

Truth table:

A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

Logical expression: $Y=A.B$

2) OR gate

Truth table:

A	B	Y
0	0	0
0	1	1
1	0	1
1	1	1

Logical expression: $Y=A+B$

3) NOT gate

Truth table

A	Y
0	1
1	0

Logical expression: $Y=\overline{A}$

Derived gates:

1) XOR gate

Truth table

A	B	Y
0	0	0
0	1	1
1	0	1
1	1	0

Logical expression: $Y=A.\overline{B}+\overline{A}.B$

2) XNOR gate

Truth table

A	B	Y
0	0	1
0	1	0
1	0	0
1	1	1

Logical expression: $Y = A.B + \overline{A}.\overline{B}$

Universal gates:

1) NAND gate

Truth table

A	B	Y
0	0	1
0	1	1
1	0	1
1	1	0

Logical expression: $Y = \overline{A.B}$

2) NOR gate

Truth table

A	B	Y
0	0	1
0	1	0
1	0	0
1	1	0

Logical expression: $Y = \overline{A + B}$

Concepts of OOP used:

1) Class

Classes are user defined data types and act as built in data types of a programming language. The entire set of data and code of object can be made a user defined data type with the help of a class. Once a class has been defined we can create any number of objects belonging to that class.

Class is simply the collection of objects of similar type.

2) Object

An object is a specimen of class. Objects are the basic run-time entities in oop. Each object contains the data and code to manipulate data.

3) Data abstraction

Abstraction refers to the act of representing essential features without including the background drafts or explanations. Classes are the concept of abstraction and are defined as list of abstract attributes and functions to operate on these attributes.

4) Data encapsulation

The wrapping of data and functions into a single unit is known as encapsulation. The data is not accessible to the outside world and only accessible to those functions which are wrapped inside the class.

5) Inheritance

Inheritance is the process in which one object acquires all the properties and behaviors of its parent object automatically. In such way you can reuse, extend or modify the attributes and behaviors which are defined in other class.

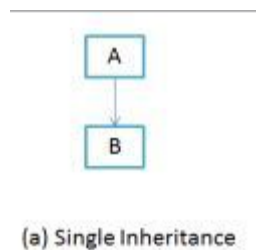
The class which inherits the members of another class is called derived class and the class whose members are inherited is called base class.

Types of inheritance:

1. Single inheritance
2. Multiple inheritance
3. Hierarchical inheritance
4. Multilevel inheritance
5. Hybrid inheritance

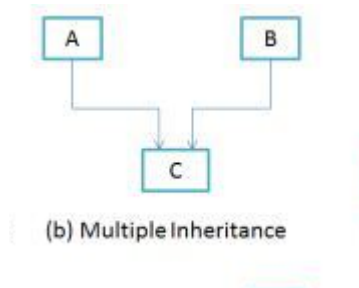
1. Single inheritance

Single inheritance is damn easy to understand. When a class extends another one class only then we call it a single inheritance. The below flow diagram shows that class B extends only one class which is A. Here A is a parent class of B and B would be a child class of A.



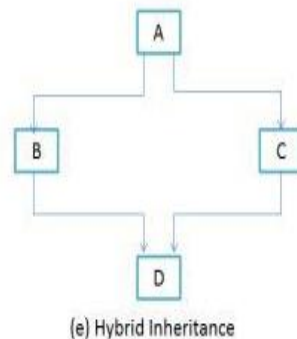
2. Multiple inheritance

“Multiple Inheritance” refers to the concept of one class extending (Or inherits) more than one base class. The inheritance we learnt earlier had the concept of one base class or parent. The problem with “multiple inheritance” is that the derived class will have to manage the dependence on two base classes.



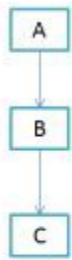
3. Hierarchical inheritance

In such kind of inheritance one class is inherited by many sub classes. In below example class B,C and D inherits the same class A. A is parent class (or base class) of B,C &D .



4. Multilevel inheritance

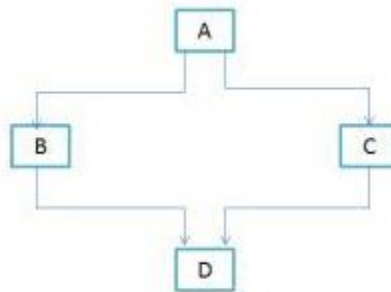
Multilevel inheritance refers to a mechanism in OO technology where one can inherit from a derived class, thereby making this derived class the base class for the new class. As you can see in below flow diagram C is subclass or child class of B and B is a child class of A.



(d) Multilevel Inheritance

5. Hybrid inheritance

In simple terms you can say that Hybrid inheritance is a combination of Single and Multiple inheritance. A typical flow diagram would look like below. A hybrid inheritance can be achieved in the java in a same way as multiple inheritance can be!! Using interfaces. yes you heard it right. By using interfaces you can have multiple as well as hybrid inheritance in Java.



(e) Hybrid Inheritance

Conclusion:

In this project by making the use of concepts of OOP like Abstraction, Encapsulation, Inheritance and Computer Graphics algorithm for line drawing i.e. DDA and Bresenham's line algorithm, we have designed logic gates simulator for verifying the truth table in Qt Creator.

