Template Week 2 – Logic

Student number:582310

Assignment 2.1: Parking lot

Which gates do you need?

> Voor de parkeerplaats met drie sensoren heb je een AND-poort nodig. Het bord mag alleen “FULL” tonen wanneer alle drie de parkeerplekken bezet zijn; in logische termen betekent dat dat de output 1 wordt als en slechts als P1=1, P2=1 en P3=1. De AND-poort modelleert precies dit “alle voorwaarden moeten waar zijn”-gedrag: één vrije plek (een 0) is al genoeg om de output 0 te houden, dus pas bij drie bezette plekken (1,1,1) gaat de LED-strip aan.

Complete this table

Parking lot 1	Parking lot 2	Parking lot 3	Result (full)
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	1

Assignment 2.2: Android or iPhone

Which gates do you need?

> Voor de telefoonkiezen-situatie heb je een XOR-poort (Exclusive OR) nodig. De medewerker mag precies één telefoon kiezen: óf Android óf iPhone, maar niet beide en ook niet geen van beide. De XOR-poort geeft output 1 wanneer precies één van de twee inputs 1 is, en 0 wanneer ze beide 0 zijn of beide 1. Daarmee leg je het "één van de twee, niet beide" principe exact vast in de logica.

Complete this table

Android phone	iPhone	Result (Phone in possession)
0	0	0
0	1	1
1	0	1
1	1	0

Assignment 2.3: Four NAND gates

Complete this table

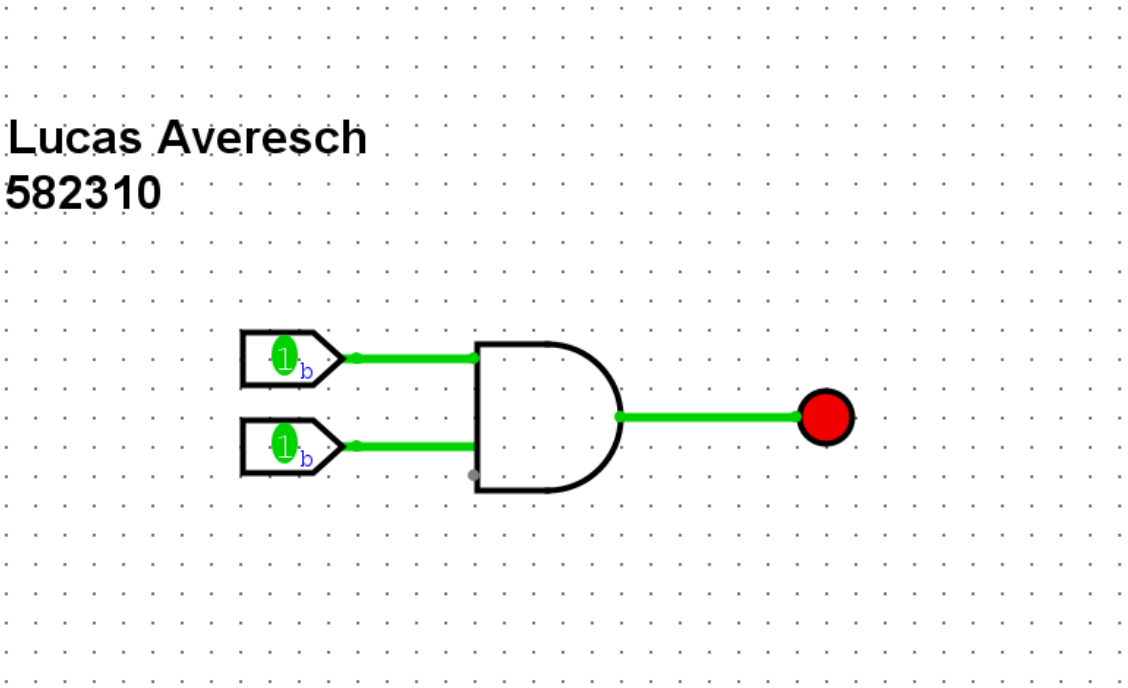
A	B	Q
0	0	1
0	1	1
1	0	1
1	1	0

How can the design be simplified?

De schakeling met vier NAND-poorten doet exact hetzelfde als één enkele NAND-poort. Uit de truth table blijkt dat Q alleen 0 is wanneer A en B beide 1 zijn, en anders altijd 1. Het ontwerp kan dus eenvoudig worden vervangen door één NAND-poort, wat het circuit compacter en efficiënter maakt

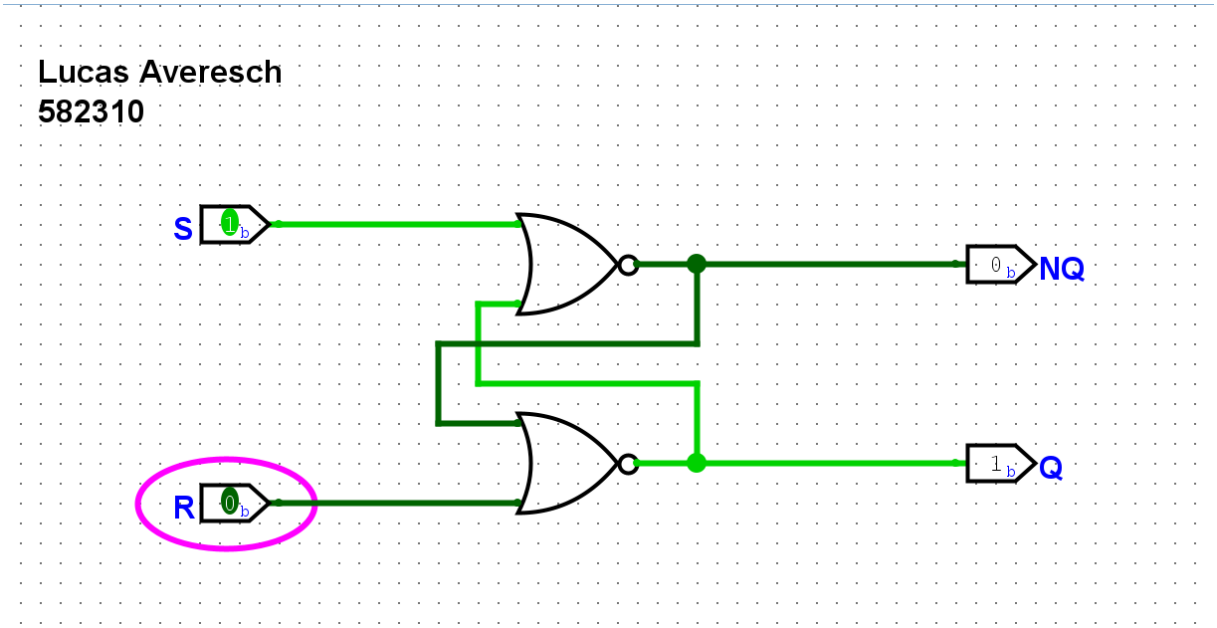
Assignment 2.4: Getting to know Logisim evolution

Screenshot of the design with your name and student number in it:



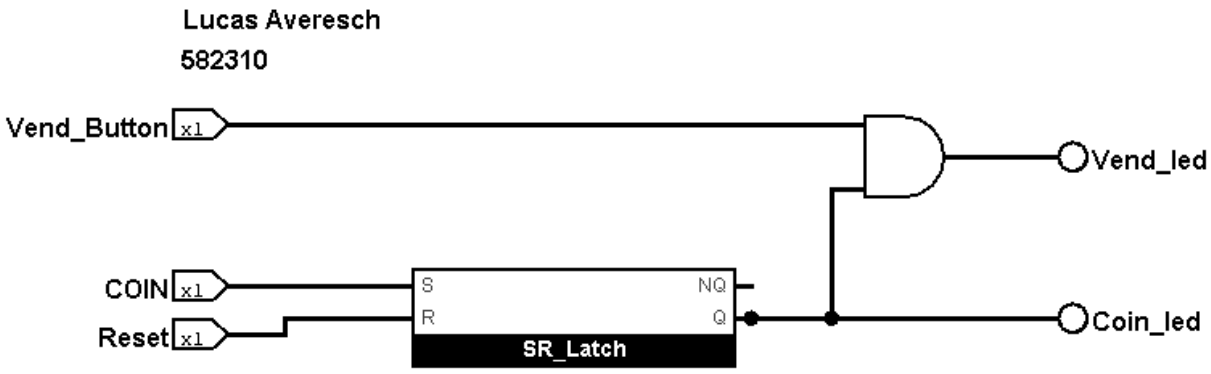
Assignment 2.5: SR Latch

Screenshot SR Latch in Logisim with your name and student number:



Assignment 2.6: Vending Machine

Screenshot Vending Machine in Logisim with your name and student number:



Assignment 2.7: Bitwise operators

1 — Even of oneven (bitwise &)

```
public class Main {
   public static void main(String[] args) {
      int number = 5;

      if ((number & 1) == 1)
         System.out.println("number is odd");
      else
         System.out.println("number is even");
   }
}
```

#2 — Power of 2 (bitwise &)

```
public class Main {
    public static void main(String[] args) {
        int number = 4;

        if (number > 0 && (number & (number - 1)) == 0)
            System.out.println("number is a power of 2");
        else
            System.out.println("number isn’t a power of 2");
    }
}
```

#3 — Check permissions (bitwise &)

```
public class Main {
    public static void main(String[] args) {
        final int READ = 4;
        final int WRITE = 2;
        final int EXECUTE = 1;

        int userPermissions = 7; // rwx

        if ((userPermissions & READ) == READ)
            System.out.println("User has read permissions");
        else
            System.out.println("User can't read. No permissions.");
    }
}
```

#4 — Assign permissions (bitwise |)

```
public class Main {
    public static void main(String[] args) {
        final int READ = 4;
        final int WRITE = 2;
        final int EXECUTE = 1;

        int userPermissions = 0;

        userPermissions = userPermissions | READ | EXECUTE;

        System.out.println("User permissions: " + userPermissions);
    }
}
```

#5 — Update permissions (bitwise ^)

```
public class Main {
    public static void main(String[] args) {
        final int READ = 4;
        final int WRITE = 2;
        final int EXECUTE = 1;

        int userPermissions = 6; // READ + WRITE

        userPermissions = userPermissions ^ WRITE;

        System.out.println("User permissions: " + userPermissions);
    }
}
```

#6 — Two's complement (bitwise ~)

```
public class Main {
    public static void main(String[] args) {
        int number = 5;

        number = ~number + 1;

        System.out.println("Number: " + number);
    }
}
```

#7 — Display binary, octal, hex

```
public class Main {
    public static void main(String[] args) {

        int number = 10;
        System.out.println("Decimal integer: " + number);

        String binary = Integer.toBinaryString(number);
        String octal = Integer.toOctalString(number);
        String hexadecimal = Integer.toHexString(number);

        System.out.println("Binary representation: " + binary);
        System.out.println("Octal representation: " + octal);
        System.out.println("Hexadecimal representation: " + hexadecimal);
    }
}
```

Assignment 2.8: Java Application Bit Calculations

Create a java program that accepts user input and presents a menu with options.

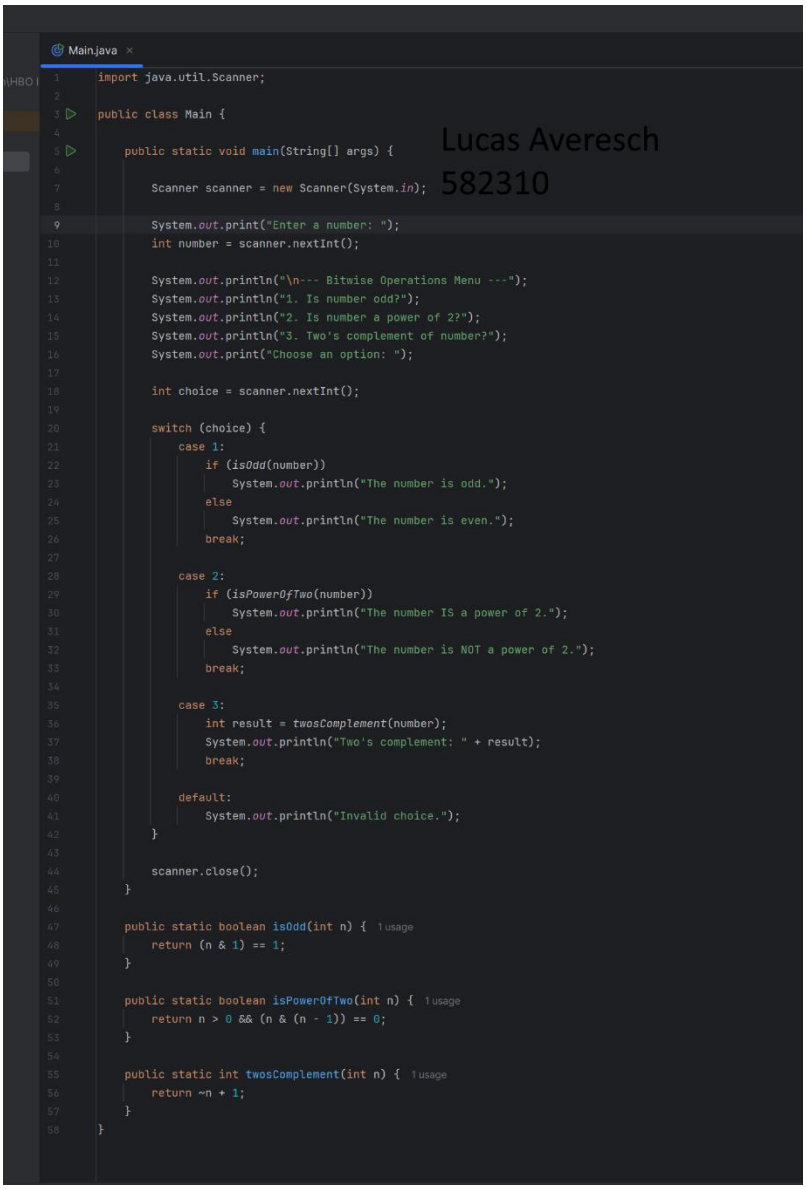
1. Is number odd?
2. Is number a power of 2?
3. Two's complement of number?

Implement the methods by using the bitwise operators you have just learned.

Organize your source code in a readable manner with the use of control flow and methods.

Keep this application because you need to expand it in week 6 for calculating network segments.

Paste source code here, with a screenshot of a working application.




```java
import java.util.Scanner;

public class Main {

    public static void main(String[] args) {

        Scanner scanner = new Scanner(System.in);

        System.out.print("Enter a number: ");
        int number = scanner.nextInt();

        System.out.println("\n--- Bitwise Operations Menu ---");
        System.out.println("1. Is number odd?");
        System.out.println("2. Is number a power of 2?");
        System.out.println("3. Two's complement of number?");
        System.out.print("Choose an option: ");

        int choice = scanner.nextInt();

        switch (choice) {
            case 1:
                if (isOdd(number))
                    System.out.println("The number is odd.");
                else
                    System.out.println("The number is even.");
                break;

            case 2:
                if (isPowerOfTwo(number))
                    System.out.println("The number IS a power of 2.");
                else
                    System.out.println("The number is NOT a power of 2.");
                break;

            case 3:
                int result = twosComplement(number);
                System.out.println("Two's complement: " + result);
                break;

            default:
                System.out.println("Invalid choice.");
        }

        scanner.close();
    }

    public static boolean isOdd(int n) {  1 usage
        return (n & 1) == 1;
    }

    public static boolean isPowerOfTwo(int n) {  1 usage
        return n > 0 && (n & (n - 1)) == 0;
    }

    public static int twosComplement(int n) {  1 usage
        return ~n + 1;
    }
}
```

```
C:\Users\lucas\.jdks\ms-21.0.8\bin\java.exe "-javaage
Enter a number: 12

--- Bitwise Operations Menu ---
1. Is number odd?
2. Is number a power of 2?
3. Two's complement of number?
Choose an option: 1
The number is even.

Process finished with exit code 0
```

```
C:\Users\lucas\.jdks\ms-21.0.8\bin\java.exe "-javaagent:C:\Pro
Enter a number: 12

--- Bitwise Operations Menu ---
1. Is number odd?
2. Is number a power of 2?
3. Two's complement of number?
Choose an option: 2
The number is NOT a power of 2.

Process finished with exit code 0
```

```
C:\Users\lucas\.jdks\ms-21.0.8\bin\java.exe "-javaagent:C
Enter a number: 12

--- Bitwise Operations Menu ---
1. Is number odd?
2. Is number a power of 2?
3. Two's complement of number?
Choose an option: 3
Two's complement: -12

Process finished with exit code 0
```

Ready? Then save this file and export it as a pdf file with the name: **week2.pdf**