IT FUNDAMENTALS

Week 2 – Digital Circuits

Assignment 2.1: Parking lot

Er zijn **3 parkeerplaatsen**.
Als **alle 3 bezet zijn**, moet het bord **FULL** laten zien.

a) What logic gate(s) do you need to make this circuit?

Hiervoor heb je een **AND-gate** nodig.

Uitleg:
Alleen als **parking lot 1**, **parking lot 2** én **parking lot 3** bezet zijn (allemaal 1), mag de uitkomst **FULL = 1** zijn.

b) Truth 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

Alleen wanneer **alle drie** de parkeerplaatsen bezet zijn, is de parkeerplaats **vol**.

Assignment 2.2: Android phone or iPhone?

Een werknemer kan **maar één telefoon** kiezen:

- Android **of**
- iPhone
  Niet allebei tegelijk.

a) What logic gate do you need to make this circuit?

Hiervoor gebruik je een **XOR-gate**.

Uitleg:
Een XOR-gate geeft alleen een **1** als **exact één** invoer 1 is.

b) Truth table

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

Als beide 1 zijn, is de uitkomst 0, omdat je **niet beide telefoons tegelijk** mag hebben.

Assignment 2.3: Four NAND gates

Een NAND-gate is het tegenovergestelde van een AND-gate.

Truth table

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

Simplification of the chip design

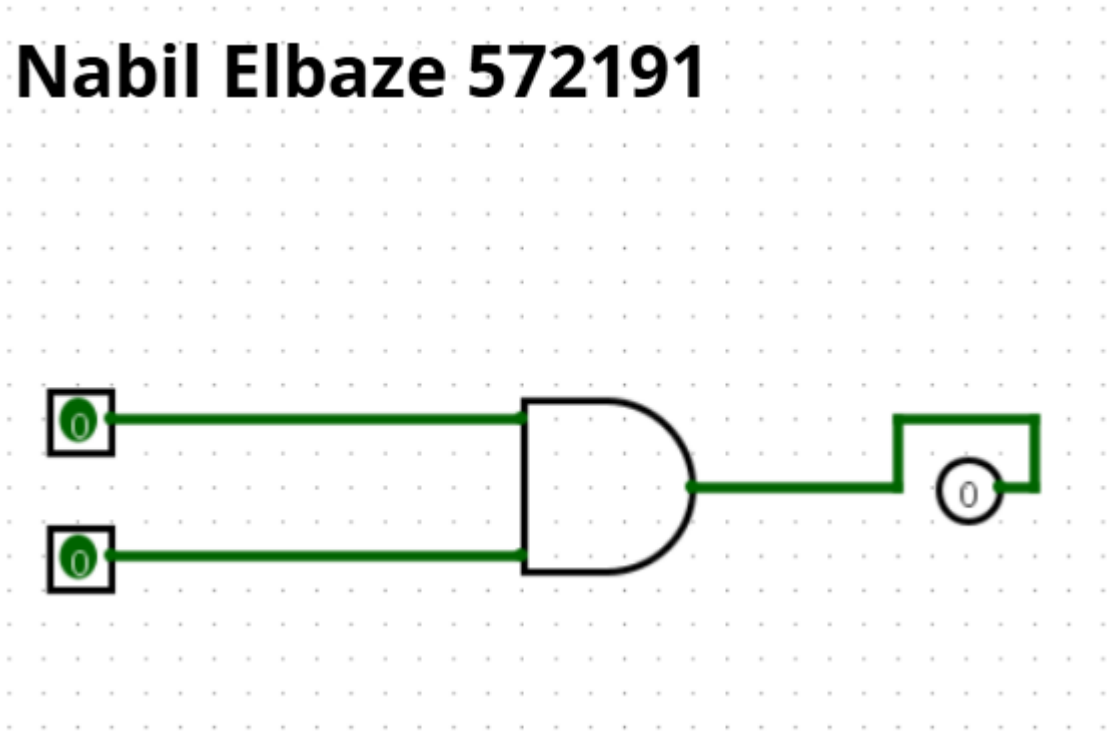
Een circuit dat bestaat uit **meerdere NAND-gates** kan vaak worden vereenvoudigd tot:

- een **AND-gate**
- een **OR-gate**
- of een **NOT-gate**

Dit is mogelijk omdat **NAND-gates universeel zijn**:
je kunt **alle andere logic gates** bouwen met alleen NAND-gates.

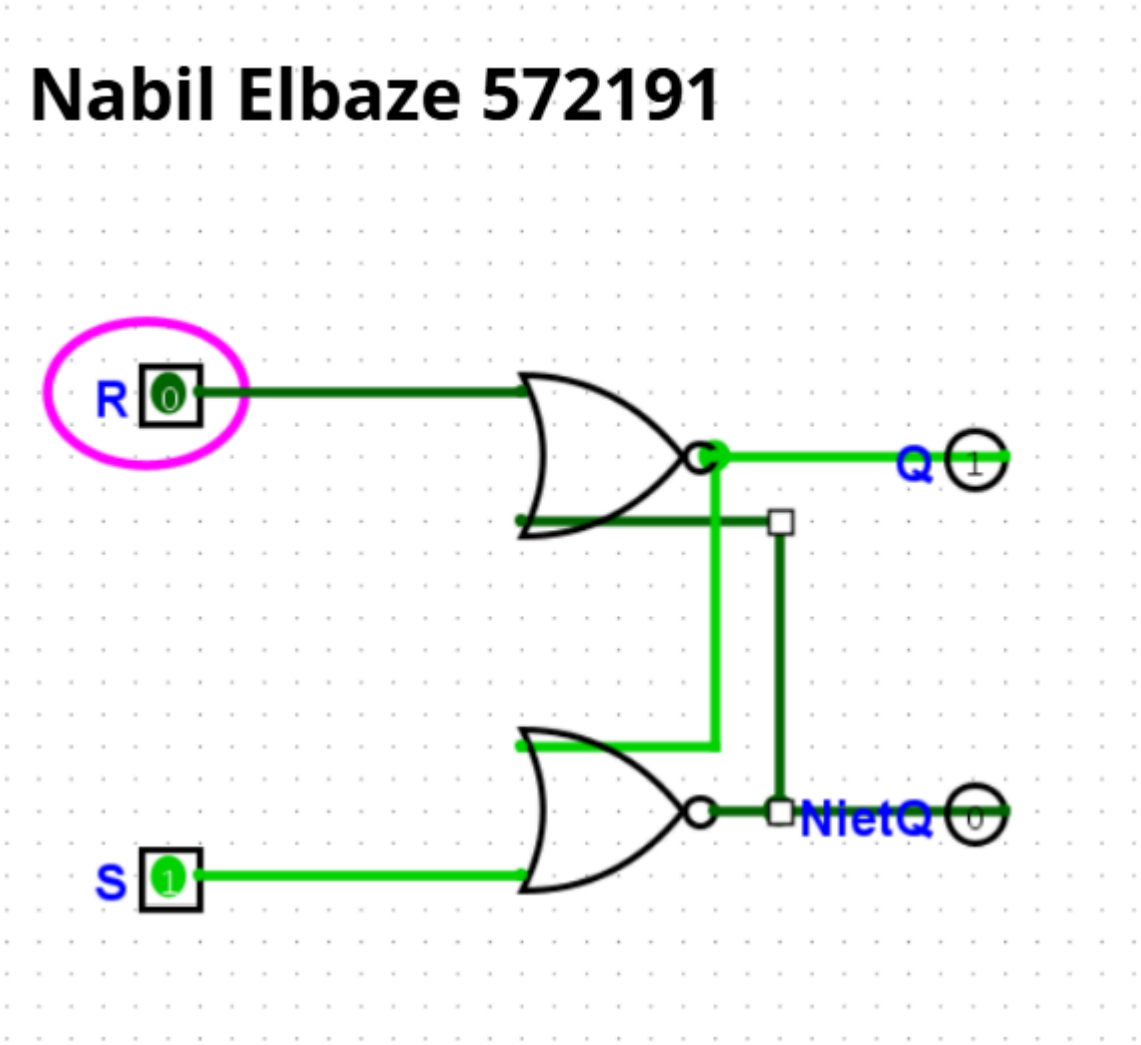
Assignment 2.4: Becoming familiar with Logisim Evolution

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



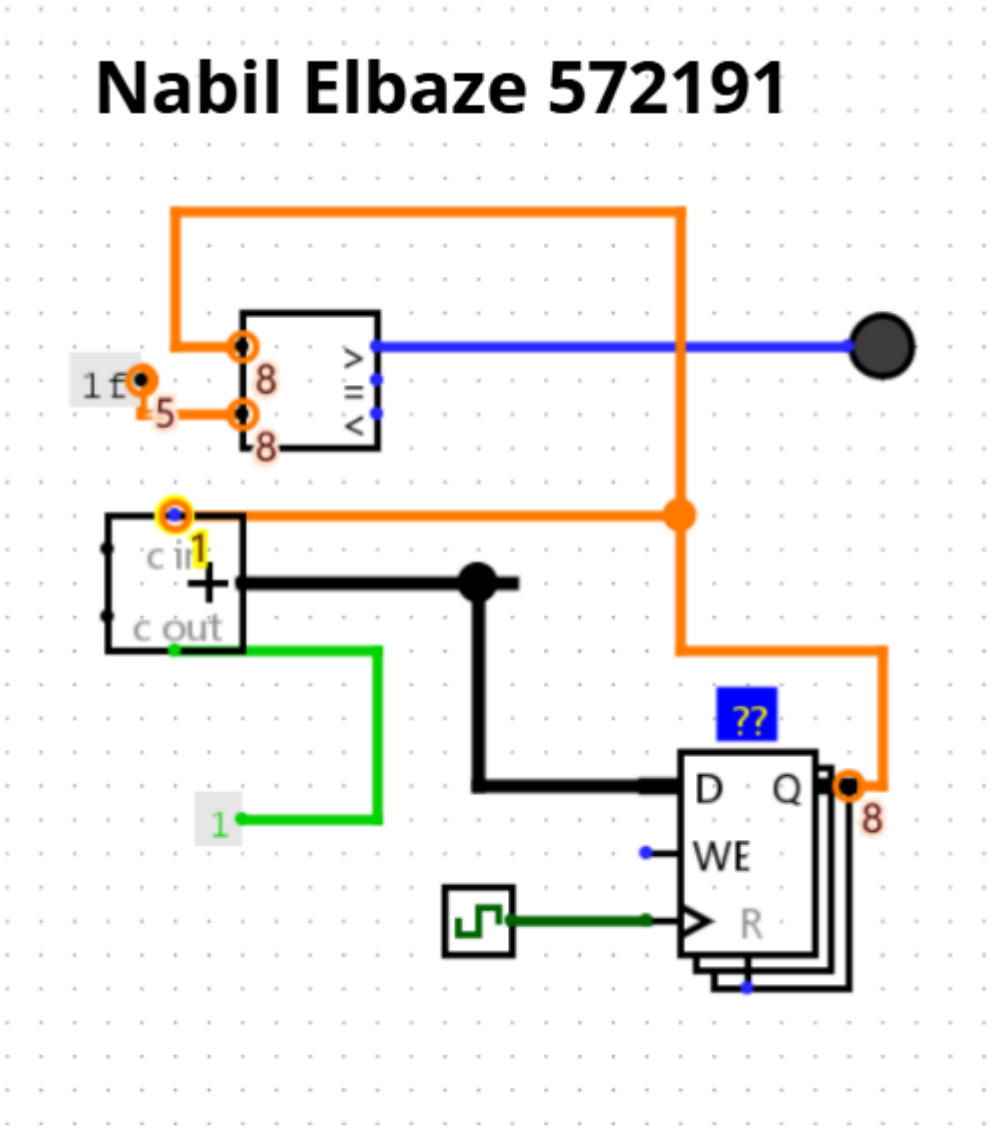
Assignment 2.5: Create an SR Latch in Logisim

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



Assignment 2.6: Create a Vending Machine

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



Assignment 2.7: Bitwise operators

Complete the java source code for bitwise operators. Put the source code here.

public class BitwiseAssignment {

public static void main(String[] args) {

int studentNumber = 572191;

int example = 0b1111; // as a example

// Bitwise AND

int andResult = studentNumber & example;

// Bitwise OR

int orResult = studentNumber | mask;

// Bitwise XOR

int xorResult = studentNumber ^ mask;

System.out.println("AND result: " + andResult);

System.out.println("OR result: " + orResult);

System.out.println("XOR result: " + xorResult); } }

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.

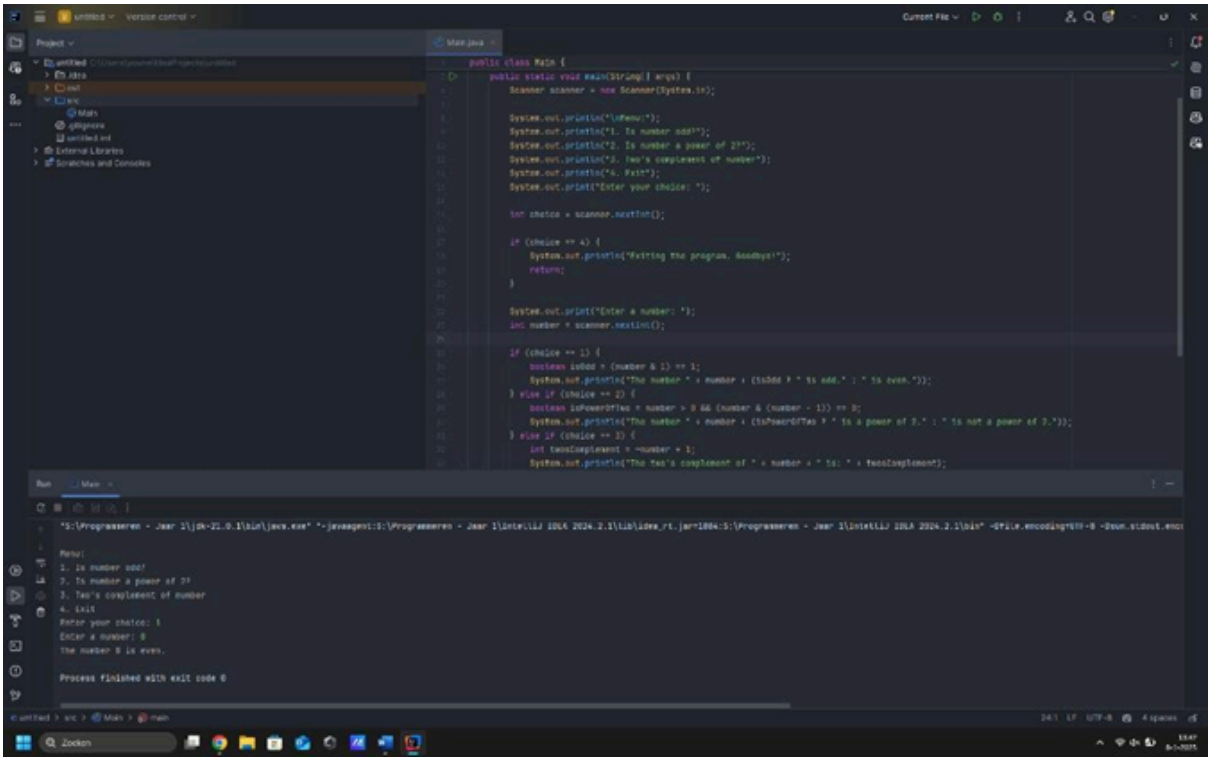
Paste source code here, with a screenshot of a working application.

import java.util.Scanner;

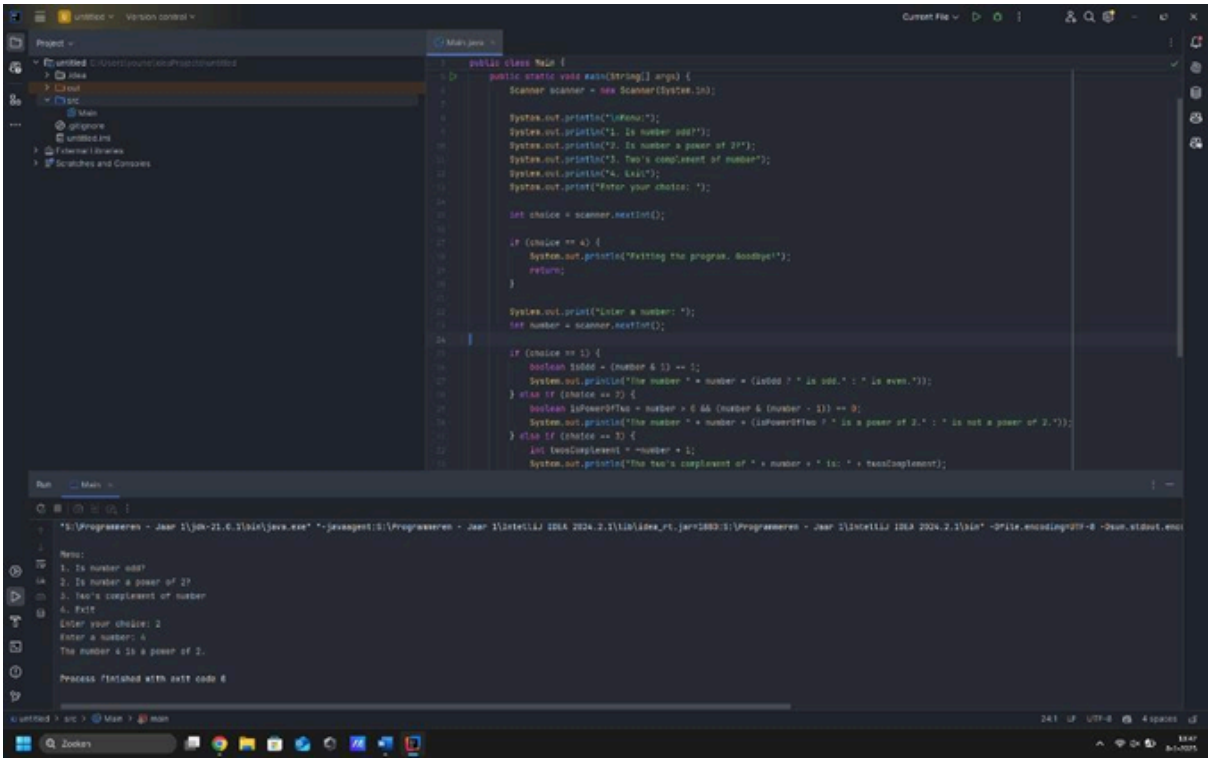
```
public class Main {
public static void main(String[] args) {
Scanner scanner = new Scanner(System.in);
System.out.println("\nMenu:");
System.out.println("1. Is number odd?");
System.out.println("2. Is number a power of 2?");
System.out.println("3. Two's complement of number");
System.out.println("4. Exit");
System.out.print("Enter your choice: ");
int choice = scanner.nextInt();
if (choice == 4) {
System.out.println("Exiting the program. Goodbye!");
return;
}
System.out.print("Enter a number: ");
int number = scanner.nextInt();
if (choice == 1) {
boolean isOdd = (number & 1) == 1;
System.out.println("The number " + number + (isOdd ? " is odd." : " is even."));
} else if (choice == 2) {
boolean isPowerOfTwo = number > 0 && (number & (number - 1)) == 0;
System.out.println("The number " + number + (isPowerOfTwo ? " is a power of 2." : " is not a
power of 2."));
} else if (choice == 3) {
int twosComplement = ~number + 1;
System.out.println("The two's complement of " + number + " is: " + twosComplement);
```

```
} else {
System.out.println("Invalid choice. Please try again.");
}
scanner.close();
}
}
```

Screenshot optie 1:



screenshot 2:



screenshot 3: