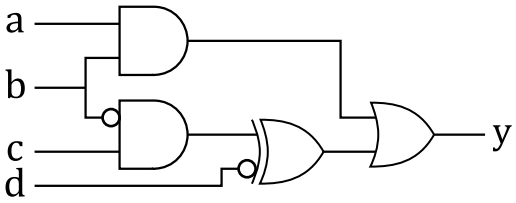
# Multiplexer and Demultiplexer

Exercises Digital Design

## 1 | MUX - Multiplexer

### 1.1 Creating a function with the help of Multiplexers

Using inverters and multiplexers from 8 to 1, draw a circuit that realizes the same function as the circuit in the adjacent figure.
Give the complete schematic of the circuit.




*mux/mux-01*

### 1.2 Creating a function with the help of Multiplexers

Using only multiplexers from 2 to 1, draw the complete schematic of a circuit that generates the exclusive-OR function of 4 inputs.
Enter the complete schematic of the circuit.

*mux/mux-02*

## 1.3 Creating a function with the help of Multiplexers

A programmable logic circuit consists exclusively of multiplexers from 2 to 1. Using a minimum number of these blocks, draw the schematic of a circuit that generates the function given in the adjacent truth table.
Give the complete schematic of the circuit.

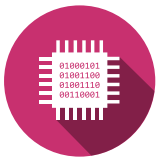
| $d$ | $c$ | $b$ | $a$ | $y$ | $z$ |
|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | - | - |
| 0 | 0 | 0 | 1 | 1 | 0 |
| 0 | 0 | 1 | 0 | 1 | 0 |
| 0 | 0 | 1 | 1 | 1 | 1 |
| 0 | 1 | 0 | 0 | 1 | 1 |
| 0 | 1 | 0 | 1 | 0 | 0 |
| 0 | 1 | 1 | 0 | 0 | 0 |
| 0 | 1 | 1 | 1 | 0 | 1 |
| 1 | 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 1 | 0 | 1 |
| 1 | 0 | 1 | 0 | 0 | 1 |
| 1 | 0 | 1 | 1 | - | - |
| 1 | 1 | 0 | 0 | - | - |
| 1 | 1 | 0 | 1 | - | - |
| 1 | 1 | 1 | 0 | - | - |
| 1 | 1 | 1 | 1 | - | - |

*mux/mux-03*

## 1.4 Creating a function with the help of Multiplexers

Using inverters, multiplexers from 2 to 1 and multiplexers from 4 to 1, create the schematic of the circuit that generates the function given in the adjacent truth table.

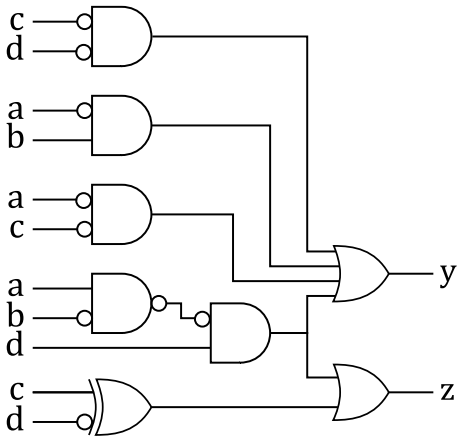
| $d$ | $c$ | $b$ | $a$ | $s$ | $t$ | $u$ | $v$ | $w$ | $x$ | $y$ | $z$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | - | - | - | - | - | - | - | - |
| 0 | 0 | 0 | 1 | - | - | - | - | - | - | - | - |
| 0 | 0 | 1 | 0 | - | - | - | - | - | - | - | - |
| 0 | 0 | 1 | 1 | 1 | - | 1 | - | - | 1 | - | 0 |
| 0 | 1 | 0 | 0 | 0 | - | - | 1 | 1 | - | 1 | - |
| 0 | 1 | 0 | 1 | 0 | - | - | 0 | 0 | - | - | 1 |
| 0 | 1 | 1 | 0 | 0 | - | - | 0 | - | 1 | 1 | - |
| 0 | 1 | 1 | 1 | 0 | - | - | 0 | - | 0 | - | 1 |
| 1 | 0 | 0 | 0 | - | 1 | 1 | - | 1 | - | 1 | - |
| 1 | 0 | 0 | 1 | - | 0 | 0 | - | 0 | - | - | 1 |
| 1 | 0 | 1 | 0 | - | 0 | 0 | - | - | 1 | 1 | - |
| 1 | 0 | 1 | 1 | - | 0 | 0 | - | - | 0 | - | 1 |
| 1 | 1 | 0 | 0 | - | 0 | - | 1 | 1 | - | 1 | - |
| 1 | 1 | 0 | 1 | - | 0 | - | 0 | 0 | - | - | 1 |
| 1 | 1 | 1 | 0 | - | - | - | - | - | - | - | - |
| 1 | 1 | 1 | 1 | - | - | - | - | - | - | - | - |



*mux/mux-04*

## 1.5 Creating a function with the help of Multiplexers

A programmable logic circuit consists exclusively of multiplexers from 2 to 1. Using a minimum number of these blocks, draw the schematic of a circuit that generates the same function as the circuit in the adjacent figure. Give the complete schematic of the circuit.




*mux/mux-05*

# 2 | MUX - Demultiplexer

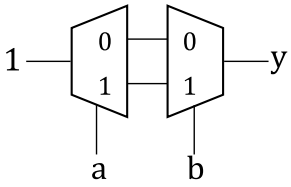
## 2.1 Demultiplexer from 1 to 8

Use inverters, AND and OR gates to draw the inner schema of a demultiplexer from 1 to 8.

*mux/demux-01*

## 2.2 Logic Circuit

Determine the logic function of the circuit in the adjacent figure.




*mux/demux-02*

## 2.3 Complete Operators

Determine whether the multiplexer from 2 to 1 is a complete operator. Do the same with the demultiplexer from 2 to 1.

*mux/demux-03*