**Binary Operations**

**Introduction:**

You remember the basic logic functions:

**NOT**, **AND**, **OR**

The logical operations **NAND**, **NOR**, **ExOR** and **ExNOR** are derived basic functions. By combining an AND gate or an OR gate with a NOT gate we are able to produce the inverse of each function. NOT AND is called NAND and NOT OR is called NOR.

Learning objectives:

By the end of this learning sequence you will be …

* … familiar with using *FluidSIM*.
* … able to realise logic operations.

**Tasks:**

1. Use *FluidSim* and draw the circuit diagram given. Use the simulation mode and find out the binary operation. Complete the truth table.

Example:

|  |  |  |
| --- | --- | --- |
| Binary operation | Circuit diagram | Truth table |
| NOT |  | |  |  | | --- | --- | | 1S1 | 1A1 | | 0 | 1 | | 1 | 0 | |

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|  |  |  |
| --- | --- | --- |
| Binary operation | Circuit diagram | Truth table |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| AND |  | |  |  |  | | --- | --- | --- | | 1S1 | 1S2 | 1A1 | | 0 | 0 | 0 | | 0 | 1 | 0 | | 1 | 0 | 0 | | 1 | 1 | 1 | |

What is the name of the valve 1V1?

German: zweidruck Ventil

English: dualpressure valve

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|  |  |  |
| --- | --- | --- |
| Binary operation | Circuit diagram | Truth table |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| OR |  | |  |  |  | | --- | --- | --- | | 1S1 | 1S2 | 1A1 | | 0 | 0 | 0 | | 0 | 1 | 1 | | 1 | 0 | 1 | | 1 | 1 | 1 | |

What is the name of the valve 1V1?

German: Wechsel Ventil

English: shuttle valve

1. Use *FluidSim* and draw the circuit diagram given. Use the simulation mode and find out the binary operation. Complete the truth table.

|  |  |  |
| --- | --- | --- |
| Binary operation | Circuit diagram | Contact circuit |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NAND |  | |  |  |  | | --- | --- | --- | | 1S1 | 1S2 | 1A1 | | 0 | 0 | 1 | | 0 | 1 | 1 | | 1 | 0 | 1 | | 1 | 1 | 0 | |

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|  |  |  |
| --- | --- | --- |
| Binary operation | Circuit diagram | Contact circuit |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NOR |  | |  |  |  | | --- | --- | --- | | 1S1 | 1S2 | 1A1 | | 0 | 0 | 1 | | 0 | 1 | 0 | | 1 | 0 | 0 | | 1 | 1 | 0 | |

1. Use *FluidSim* and draw the circuit diagram given. Use the simulation mode and find out the binary operation. Complete the truth table.

|  |  |  |
| --- | --- | --- |
| Binary operation | Contact circuit | Contact circuit |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| XOR |  | |  |  |  | | --- | --- | --- | | 1S1 | 1S2 | 1A1 | | 0 | 0 | 0 | | 0 | 1 | 1 | | 1 | 0 | 1 | | 1 | 1 | 0 | |

1. Describe the difference between the following two valves! Write down complete sentences either in English or in German. Work in pairs and use an online dictionary if necessary.

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The left one is a normaly closed and the right one is a normaly open valve