**2. Boolean algebra**

**2.1 Calculate each of the following expressions**

You must calculate the value (0 or 1, true or false).

1. -> Read as TRUE AND NOT-FALSE -> Result is FALSE (0).
2. -> Read as TRUE OR NOT-TRUE -> Result is TRUE (1).
3. -> Read as NOT-FALSE AND FALSE -> Result is FALSE (0).
4. -> Read as NOT (TRUE OR FALSE)-> Result is FALSE (0).

**2.2 Use a table to calculate the values of the functions below**

You must do this for all values of the input arguments (i.e. you need to construct the truth table)

|  |  |  |
| --- | --- | --- |
| x | 1 | F(x) |
| 0 | 1 | 1 |
| 1 | 1 | 1 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| x | y |  |  |  |
| 0 | 1 | 1 | 0 | 0 |
| 1 | 1 | 1 | 0 | 0 |
| 0 | 0 | 1 | 0 | 0 |
| 1 | 0 | 1 | 0 | 0 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| x | y | z |  |  |  |
| 0 | 0 | 0 | 1 | 1 | 1 |
| 1 | 0 | 0 | 0 | 1 | 1 |
| 0 | 1 | 0 | 1 | 1 | 1 |
| 1 | 1 | 0 | 0 | 1 | 1 |
| 0 | 0 | 1 | 1 | 0 | 0 |
| 1 | 0 | 1 | 0 | 0 | 0 |
| 0 | 1 | 1 | 1 | 0 | 1 |
| 1 | 1 | 1 | 0 | 0 | 0 |

**2.3 Find the output of each of the circuits given below**

So you must deduce a Boolean expression that matches the circuit and create the truth table for that expression

1. A diagram of a circuit

   Description automatically generated  
     
   Gives the following expression:

From the expression we can establish this truth-table:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| x | y | z |  |  |  |  |
| 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| 0 | 1 | 0 | 1 | 1 | 0 | 0 |
| 1 | 1 | 0 | 0 | 1 | 0 | 0 |
| 0 | 0 | 1 | 1 | 0 | 1 | 1 |
| 1 | 0 | 1 | 0 | 0 | 1 | 0 |
| 0 | 1 | 1 | 1 | 0 | 0 | 0 |
| 1 | 1 | 1 | 0 | 0 | 0 | 0 |

1. A diagram of a circuit

   Description automatically generated

Gives the following expression:

From the expression we can establish this truth-table:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| x | y |  |  |  |  |  |
| 0 | 0 | 1 | 1 | 0 | 1 | 1 |
| 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| 1 | 1 | 0 | 0 | 1 | 0 | 1 |

1. A diagram of a block diagram

   Description automatically generated  
   Gives the following expression:

From the expression we can establish this truth-table:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| x | y | z |  |  |  |  |
| 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| 1 | 0 | 0 | 1 | 1 | 1 | 1 |
| 0 | 1 | 0 | 1 | 1 | 1 | 1 |
| 1 | 1 | 0 | 1 | 0 | 1 | 1 |
| 0 | 0 | 1 | 0 | 1 | 0 | 1 |
| 1 | 0 | 1 | 0 | 1 | 1 | 1 |
| 0 | 1 | 1 | 0 | 1 | 0 | 1 |
| 1 | 1 | 1 | 0 | 0 | 1 | 1 |

**4. OR Gate**

**4.1 Theory**

Draw the truth-table describing the logic from the circuit below:

A diagram of a block diagram

Description automatically generated

Expression:

|  |  |  |  |
| --- | --- | --- | --- |
| a | b |  |  |
| 0 | 0 | 1 | 0 |
| 1 | 0 | 1 | 0 |
| 0 | 1 | 1 | 0 |
| 1 | 1 | 0 | 1 |