Name: ……………………………………………….. ( ) Class: ……… Date: …………………..

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| --- | --- | --- |
| **2.1** | **Computer Architecture** | **Boolean Logic and Logic Gates** |

1. Complete the table below on the different ways to represent Boolean values.

|  |  |
| --- | --- |
| **Logic States** | |
| 0 | 1 |
|  | True |
|  | On |
| Low |  |

1. Identify the following logic gates:

  

c)

b)

a)

1. Summarise each of the following scenarios using a truth table.
2. If it rains, bring an umbrella. If it does not rain, an umbrella is not needed.

|  |  |
| --- | --- |
| **Input** | **Output** |
| *Rain? (True/False)* | *Umbrella needed? (True/False)* |
|  |  |
|  |  |

1. Alex needs to be at school by 7.30 a.m. To take a cab to school, the fare costs $10.

If Alex is late for school and has enough money, he will take a taxi. If Alex is late for school but does not have enough money, he can only take a bus. If he is not late, he will take a bus to school regardless of how much money he has.

As an example, the first row has been filled in.

|  |  |  |
| --- | --- | --- |
| **Inputs** | | **Output** |
| *Is late for school? (True/False)* | *Has at least $10? (True/False)* | *Will take taxi to school? (True/False)* |
| False | False | False |
|  |  |  |
|  |  |  |
|  |  |  |

1. For each of the following 2-input logic gates, write down the corresponding Boolean statement where X and Y denote inputs, while Q denotes output.

|  |  |
| --- | --- |
| **Logic Gate** | **Boolean Statement** |
| AND |  |
| OR |  |
| NAND |  |
| NOR |  |

1. Complete the truth tables of the following 2-input logic gates:
2. AND gate b) OR gate

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Inputs** | | **Output** |  | **Inputs** | | **Output** |
| **X** | **Y** | **Q** |  | **X** | **Y** | **Q** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
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1. NAND gate d) NOR gate

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Inputs** | | **Output** |  | **Inputs** | | **Output** |
| **X** | **Y** | **Q** |  | **X** | **Y** | **Q** |
|  |  |  |  |  |  |  |
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1. A burglar alarm is activated when the switch is on and the motion sensor detects movement.

The following table describes the inputs the system:

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| --- | --- | --- |
| **Input** | **Binary** | **Condition** |
| Switch | 0 | Switch is off |
| 1 | Switch is on |
| Motion Sensor | 0 | No movement detected |
| 1 | Movement detected |

1. Draw a suitable logic gate that can be used for the above scenario and label the input(s) and output(s) accordingly.
2. Draw the truth table for all possible combinations of inputs.
3. Logic Gate:
4. Truth Table:

|  |  |  |
| --- | --- | --- |
| **Inputs** | | **Output** |
| **Switch** | **Motion Sensor** | **Alarm** |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |