Smart Home

LO: Logical systems with varying numbers of inputs

# One Sensor

A smart home system has a set of lights that only come on when it is dark.

The system has a light sensor (S) which is ON when the ambient light from outside is greater 150 LUX and OFF if the light level falls below this. The sensor is connected to a microcontroller that also connects to a light switch (L). If the switch is ON the lights in the room are ON. In any BOOLEAN system, ON and OFF are the same as TRUE and FALSE.

|  |
| --- |
| Write a BOOLEAN STATEMENT that describes this system: |
| L = |

When drawing a truth table for a system with a single input, the full range of possible inputs looks like this:

|  |  |
| --- | --- |
| S | L |
| True |  |
| False |  |

Complete the truth table above for this system with a single input.

# Two Sensors

In order to better save energy, the system is fitted with an additional sensor (H) that detects the body heat of a human occupant. The sensor outputs TRUE if there is at least 1 person in the room. The lights should only be on if it is dark enough and there is someone in the room.

|  |
| --- |
| Modify your BOOLEAN STATEMENT from above to take account of this new sensor: |
| L = |

With 2 inputs, the truth table covering the full range of possible combinations looks like this:

|  |  |  |
| --- | --- | --- |
| S | H | L |
| True | **True** |  |
| True | **False** |  |
| False | **True** |  |
| False | **False** |  |

Complete the truth table for the system with 2 inputs.

# Three Sensors

Occupants of the house are concerned that the lights come on automatically when the curtains are still open, so people outside can see in. The system is upgraded to include a sensor to determine whether curtains are open or closed (C). The lights should not come on if the curtains are open.

|  |
| --- |
| Modify your BOOLEAN STATEMENT from above to take account of this new sensor: |
| L = |

With 3 inputs, the truth table covering all possible combinations of input looks like this:

|  |  |  |  |
| --- | --- | --- | --- |
| S | H | C | L |
| True | **True** | **True** |  |
| True | **True** | **False** |  |
| True | **False** | **True** |  |
| True | **False** | **False** |  |
| False | **True** | **True** |  |
| False | **True** | **False** |  |
| False | **False** | **True** |  |
| False | **False** | **False** |  |

Complete the truth table for the system with 3 inputs

# Four Inputs

The occupants of the house enjoy watching movies on their home cinema system, but complain that the lights spoil the atmosphere. The system is modified to include a sensor (T) to detect when the television is watching a movie.

|  |
| --- |
| Modify your BOOLEAN STATEMENT from above to take account of this new sensor: |
| L = |

With 4 inputs, every possible combination looks like this:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| S | H | C | T | L |
| True | **True** | **True** | **True** |  |
| True | **True** | **True** | **False** |  |
| True | **True** | **False** | **True** |  |
| True | **True** | **False** | **False** |  |
| True | **False** | **True** | **True** |  |
| True | **False** | **True** | **False** |  |
| True | **False** | **False** | **True** |  |
| True | **False** | **False** | **False** |  |
| False | **True** | **True** | **True** |  |
| False | **True** | **True** | **False** |  |
| False | **True** | **False** | **True** |  |
| False | **True** | **False** | **False** |  |
| False | **False** | **True** | **True** |  |
| False | **False** | **True** | **False** |  |
| False | **False** | **False** | **True** |  |
| False | **False** | **False** | **False** |  |

Complete the truth table for 4 inputs