DOC Course 112: Hardware: Tutorial 1 Solution

1. It should of course say "*Enter through door 1 or door 3*"

2.

A B C	A+ B+C	(A+B+C)'	A'	B'	C'	A'•B'•C'
0 0 0	0	1	1	1	1	1
0 0 1	1	0	1	1	0	0
0 1 0	1	0	1	0	1	0
0 1 1	1	0	1	0	0	0
1 0 0	1	0	0	1	1	0
1 0 1	1	0	0	1	0	0
1 1 0	1	0	0	0	1	0
1 1 1	1	0	0	0	0	0

3.

Boolean	Arithmetic implementation
A• B'	A*(1-B)
A + B	A+B-A*B
A' + B'	1-A*B
A eor B	(A+B) mod 2 or A+B-2*A*B

4. There are a lot of possibilities here. To make it into an unambiguous proposition you need to add some brackets. I would preserve the either or nesting

(Coffee) and ((biscuits and (cheese or icecream or freshfruit)) or applepie)

equally well you could have:

((Coffee) and (biscuits and (cheese or icecream) or freshfruit)) or applepie

&c.

Optional problem:

The simplest proof is by induction. In part 2 you proved that it works for 3 variables, so the first step is to assume it works for n variables, thus:

(A1 + A2 + A3 + ... An)' = A1'•A1'• A3' . . . . An'

now consider the case of n+1 variables

(A1 + A2 + A3 + ... An + An+1)' = ((A1 + A2 + A3 + ... An) + An+1) = (B+An+1)'

where B = A1 + A2 + A3 . . . . + An

since we can prove the theorem for the case of two variables by truth table we can write:
(B+An+1)' = B' • An+1' = (A1 + A2 + A3 + ... An)' • An+1' = A1'•A1'• A3' . . . . An'' • An+1'

Thus if it works for n variables it works for n+1 variables.

QED