Tutorial 1: Solution

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

2

ABC	$A+B+C$	$(A+B+C)'$	A'	B'	C'	$A' \cdot B' \cdot C'$
000	0	1	1	1	1	1
001	1	0	1	1	0	0
010	1	0	1	0	1	0
011	1	0	1	0	0	0
100	1	0	0	1	1	0
101	1	0	0	1	0	0
110	1	0	0	0	1	0
111	1	0	0	0	0	0

3

Boolean	Arithmetic impelmentation
$A \cdot B$	$A \times (1 - B)$
$A + B$	$A + B - A \times B$
$A + B$	$1 - A \times B$
$A \oplus B$	$A + B - 2 \times A \times B$

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.

5. The simplest proof is by induction. In part 2 you proved that it works for 3 variables, and we can use the same method to prove that it works for two variables ($(A + B)' = A' \cdot B'$). Now let us assume that it is true for n variables, thus:

$$(A_1 + A_2 + A_3 + ...A_n)' = A_1' \cdot A_1' \cdot A_3'....A_n'$$

now let:

$$B = (A_1 + A_2 + A_3 + ...A_n)$$

thus

$$B' = A_1' \cdot A_1' \cdot A_3'....A_n'$$

now apply de Morgan's theorem as follows:

$$(B + A_{n+1})' = B' \cdot A_{n+1}'$$

substituting for B abd B' we get

$$(A_1 + A_2 + A_3 + ...A_n + A_{n+1})' = A_1' \cdot A_1' \cdot A_3'....A_n' \cdot A_{n+1}'$$

Thus it is true for n+1 variables, and by induction is true for any number of variables.