Department of Computing
Course 112 - Hardware
Tutorial 2 Solution

1a.

$\mathbf{((A\cdot B')' + B')\cdot B} = (A \bullet B')' \bullet B + B' \bullet B = (A'+B) \bullet B = A' \bullet B + B = (A' + 1) \bullet B = B$

1b.

$\mathbf{A+((A\cdot B')'\cdot C)}$ (use the curious distributive law)

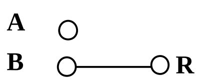
$= (A + (A\bullet B')') \bullet (A+C)$ (followed by de Morgan)

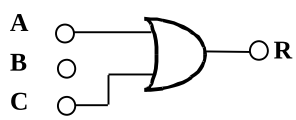
$= (A + A' + B) \bullet (A+C) = (1 + B) \bullet (A+C) = A+C$

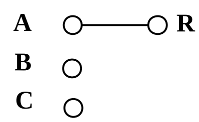
1c.

$\mathbf{A + ((B+C)'\cdot A) = A}$ (using the simplifying rule $A + A\bullet B = A$)

2.







3.

A	B	C	R
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

B C

A	00	01	11	10
0	0	1	1	1
1	1	1	0	1

$\mathbf{R} = A'\bullet B'\bullet C + A'\bullet B\bullet C' + A'\bullet B\bullet C + A\bullet B'\bullet C' + A\bullet B'\bullet C + A\bullet B\bullet C'$

Simplify using the Karnaugh map method:

$R = A\bullet B' + A'\bullet C + B\bullet C'$

4. $\mathbf{R = (A+B+C)} \bullet (A'+B'+C')$

multiply out to get:

$R = A\bullet A' + A\bullet B' + A\bullet C' + B\bullet A' + B\bullet B' + B\bullet C' + C\bullet A' + C\bullet B' + C\bullet C'$

$= A\bullet B' + A\bullet C' + B\bullet A' + B\bullet C' + C\bullet A' + C\bullet B'$

$= (A\bullet B' + A'\bullet C + B\bullet C') + (A'\bullet B + A\bullet C' + B'\bullet C)$

to prove that this is the same as the answer to part c we need to prove that

$A\bullet B' + A'\bullet C + B\bullet C' = A'\bullet B + A\bullet C' + B'\bullet C$

we augment each term of the equation as follows:

$A\bullet B'\bullet (C+C') + A'\bullet C\bullet (B+B') + B\bullet C'\bullet (A+A') = A'\bullet B\bullet (C+C') + A\bullet C'\bullet (B+B') + B'\bullet C\bullet (A+A')$

multiply out

$A\bullet B'\bullet C+ A\bullet B'\bullet C'+ A'\bullet B\bullet C+ A'\bullet B'\bullet C+ A\bullet B\bullet C'+ A'\bullet B\bullet C'$

$= A'\bullet B\bullet C+ A'\bullet B\bullet C'+ A\bullet B\bullet C'+ A\bullet B'\bullet C'+ A\bullet B'\bullet C+ A'\bullet B'\bullet C$

QED