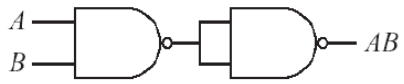
Homework Lecture 1 (solutions)

1. Exercise A.1



2. Exercise A.4

A	B	C	F	G
0	0	0	0	1
0	0	1	1	0
0	1	0	0	1
0	1	1	1	0
1	0	0	0	0
1	0	1	1	0
1	1	0	1	1
1	1	1	1	0

3. Exercise A.7

$g = (A \oplus C)B$

$g = (A \cdot \bar{C} + \bar{A} \cdot C)B$

$g = A \cdot B \cdot \bar{C} + \bar{A} \cdot B \cdot C$

This is not equal to f.

4. Exercise A.8;

A	B	C	F
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	0

$$F(A,B,C) = \bar{A}\bar{B}C$$

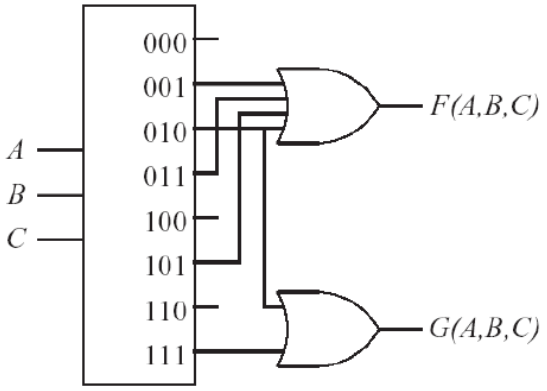
Or use algebraic method:

$F = (\overline{A+B}) \cdot C$

Use DeMorgan: $\overline{A+B} = \bar{A} \cdot \bar{B}$

$F = \bar{A} \cdot \bar{B} \cdot C$

5. Exercise A.14



6. A property of the GRAY code is that there is exactly 1 bit change between two consecutive numbers. The GRAY code is also used in the Karnaugh map.
Give the sequence of sixteen consecutive GRAY numbers. Start with number 0000.

```
0000
0001
0011
0010
0110
0111
0101
0100
1100
1101
1111
1110
1010
1011
1001
1000
```

Constructing the Gray code is easy.

- start with 1 bit Gray code. That is easy

```
0
1
```

- Now the GRAY code for 2 bits. First mirror the previous pattern (1-bit Gray)

```
0
1
1
0
```

Next extend first 2 lines with 0 and last 2 lines with 1.

```
00
01
11
10
```

- Now the GRAY code for 3 bits. First mirror the previous pattern (2-bit Gray) and extend with extra bit.

```
000
001
011
010
110
111
101
100
```

7. Exercise A.37

Minimal SOP-form

CD

AB	00	01	11	10
00	d			1
01				
11				
10	1	d	1	1

AB

CD	00	01	11	10
00	d			1
01				d
11				1
10	1			1

$F = A \cdot \bar{B} + \bar{B} \cdot \bar{D}$

Minimal POS-form (EE-students; "Digital Hardware")

Zeros are explicitly shown (ones are hidden). You may also show all ones, zeros and don't cares explicitly.

CD

AB	00	01	11	10
00	d	0	0	
01	0	0	0	0
11	0	0	0	0
10		d		

$F = \overline{\overline{B + \bar{A} \cdot D}}$

Use DeMorgan

$F = \bar{B} \cdot (\overline{\overline{\bar{A} \cdot D}})$

Use DeMorgan

$F = \bar{B} \cdot (A + \bar{D})$