

# CS2700 Homework 2

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## Question 1.

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11.1

(a)  $ABC + \overline{A} * \overline{B} * \overline{C}$

$ABC$	$\overline{A} * \overline{B} * \overline{C}$	$ABC$	$\overline{A} * \overline{B} * \overline{C}$	$ABC + \overline{A} * \overline{B} * \overline{C}$
000	111	0	1	1
001	110	0	0	0
010	101	0	0	0
011	100	0	0	0
100	011	0	0	0
101	010	0	0	0
110	001	0	0	0
111	000	0	0	1

(b)  $ABC + \overline{A}\overline{B} * \overline{C} + \overline{A} * \overline{B} * \overline{C}$

$ABC$	$\overline{A} * \overline{B} * \overline{C}$	$ABC$	$\overline{A}\overline{B} * \overline{C}$	$A * \overline{B} * \overline{C}$	$ABC + \overline{A}\overline{B} * \overline{C} + \overline{A} * \overline{B} * \overline{C}$
000	111	0	1	0	1
001	110	0	0	0	0
010	101	0	0	0	0
011	100	0	0	0	0
100	011	0	0	1	1
101	010	0	0	0	0
110	001	0	0	0	0
111	000	1	0	0	1

(c)  $A(\overline{BC} + \overline{BC})$ 

$ABC$	$\overline{A} * \overline{B} * \overline{C}$	$\overline{BC}$	$\overline{BC}$	$A(\overline{BC} + \overline{BC})$
000	111	0	0	0
001	110	0	1	0
010	101	1	0	0
011	100	0	0	0
100	011	0	0	0
101	010	0	1	1
110	001	1	0	1
111	000	0	0	0

(d)  $(A + B)(A + C)(\overline{A} + \overline{B})$ 

$ABC$	$\overline{A} * \overline{B} * \overline{C}$	$A + B$	$A + C$	$\overline{A} + \overline{B}$	$(A + B)(A + C)(\overline{A} + \overline{B})$
000	111	0	0	1	0
001	110	0	1	1	0
010	101	1	0	1	0
011	100	1	1	1	1
100	011	1	1	1	1
101	010	1	1	1	1
110	001	1	1	0	0
111	000	1	1	0	0

**Question 2.**

11.3

(a)  $F = \overline{V + A + L} = \overline{V} * \overline{A} * \overline{L}$ 

$VAL$	$\overline{V} * \overline{A} * \overline{L}$	$F$
000	111	1
001	110	0
010	101	0
011	100	0
100	011	0
101	010	0
110	001	0
111	000	0

(b)  $F = \overline{A} + \overline{B} + \overline{C} + \overline{D} = \overline{ABCD}$

$ABCD$	$\overline{A} * \overline{B} * \overline{C} * \overline{D}$	$F$
0000	1111	1
0001	1110	0
0010	1101	0
0011	1100	0
0100	1011	0
0101	1010	0
0110	1001	0
0111	1000	0
1000	0111	0
1001	0110	0
1010	0101	0
1011	0100	0
1100	0011	0
1101	0010	0
1110	0001	0
1111	0000	0

### Question 3.

3.3 32 bit instruction, 8bit opcode, 24bit address

(a)  $2^4 = 2^0 * 2^4 = 1 \text{ megabyte} * 16 = 16 \text{ megabytes of addressable memory}$

- (b) 1. 32bit address on a 16bit bus will take 3 cycles, 1 for the address and two for the data  
 2. 16 bit address on 16 bit bus will take 4 cycles, 2 for the address and two for data

- (c) 24bits for the program counter and 32 bits for the instruction register

**Question 4.**

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3.7

- (a) A factor of 2
- (b) 50 transfers, 25 of one byte, 25 of two bytes 75 transfers,  $25 + 25 * 2$  A difference factor of 1.5

**Question 5.**

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4.2

- (a) 8bit tag, 14bit set, 2bit word

0x11111111  $\rightarrow$  000100010001000100010001

Tag	Set	Word
00010001	00010001000100	01
11	444	1

0x66666666  $\rightarrow$  011001100110011001100110

Tag	Set	Word
01100110	01100110011001	10
66	1999	2

0xBBBBBB  $\rightarrow$  10111011101110111011101

Tag	Set	Word
10111011	1011101110111	01
BB	2EEE	3

- (b) 22bit Tag 2bit Word

0x11111111  $\rightarrow$  000100010001000100010001

Tag	Word
0001000100010001000100	01
44444	1

0x66666666  $\rightarrow$  011001100110011001100110

Tag	Word
0110011001100110011001	10
19999	2

0xBBBBBB  $\rightarrow$  10111011101110111011101

Tag	Word
101110111011101110111	01
2EEEE	3