

Lösningsförslag till tentamen ETE235 Digitalteknik 2012-06-19

1a)

$209/2$	$=$	104	REST 1	LSB
$104/2$	$=$	52	REST 0	
$52/2$	$=$	26	REST 0	
$26/2$	$=$	13	REST 0	
$13/2$	$=$	6	REST 1	
$6/2$	$=$	3	REST 0	
$3/2$	$=$	1	REST 1	
$1/2$	$=$	0	REST 1	MSB

$$209_{10} = 11010001_2$$

1b)

$$\underbrace{10011110}_2 = 9E_{16}$$

1c)

$$\underbrace{10011110}_2 = 236_8$$

1d)

$$10011110_2 =$$

$$= 1 \cdot 2^7 + 0 \cdot 2^6 + 0 \cdot 2^5 + 1 \cdot 2^4 + 1 \cdot 2^3 + 1 \cdot 2^2 + 1 \cdot 2^1 + 0 \cdot 2^0$$

$$= 128 + 0 + 0 + 16 + 8 + 4 + 2 + 0 = 158_{10}$$

1e)

$$\underbrace{10011110}_2 = \underbrace{0001}_1 \underbrace{0101}_5 \underbrace{1000}_8 \text{ BCD}$$

1f)

$0,65625 \cdot 2$	$=$	$0,3125$	$+ 1$	MSB
$0,3125 \cdot 2$	$=$	$0,625$	$+ 0$	
$0,625 \cdot 2$	$=$	$0,25$	$+ 1$	
$0,25 \cdot 2$	$=$	$0,5$	$+ 0$	
$0,5 \cdot 2$	$=$	0	$+ 1$	LSB

$$0,65625_{10} = 0.10101_2$$

19/

$$\begin{array}{r} 1001110 \\ - \quad \quad \quad 1 \\ \hline 10011101 \end{array}$$

$$01100010_2 = +98_{10}$$

ALLTSA

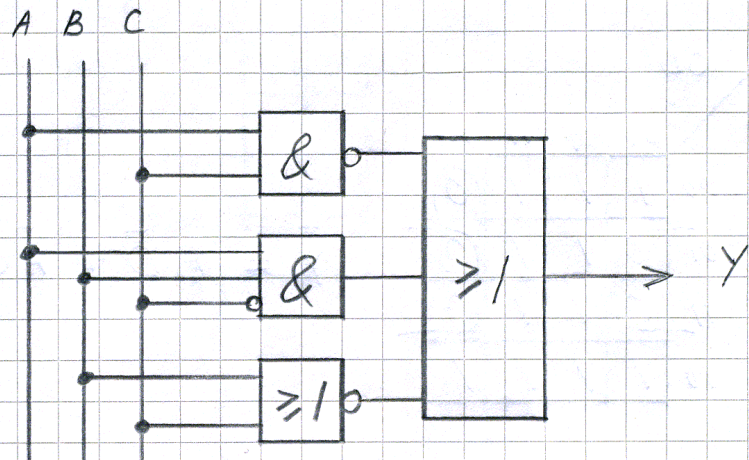
$$10011110 = -98$$

REPRESENTATION ENLIGT
TVÅKOMPLEMENTMETODEN
" " " "
IMNEBAR ATT VÄNSTRA
" " " "
BITEN ÄR TECKENBIT.

0 = PLUS

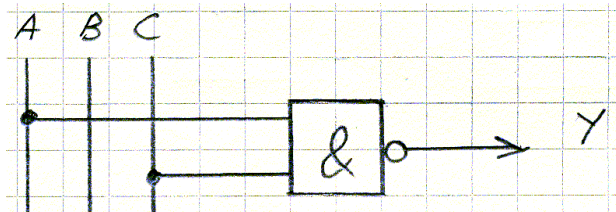
1 = MINUS

2a/



2b/

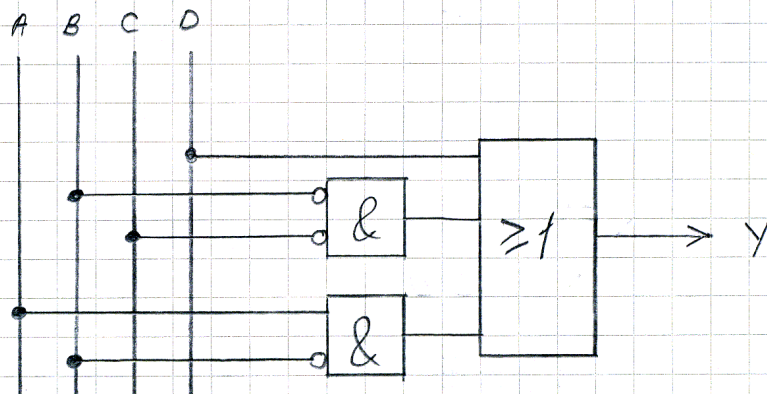
$$\begin{aligned}
 Y &= \overline{A}C + AB\overline{C} + (\overline{B+C}) = \\
 &= \overline{A} + \overline{C} + AB\overline{C} + \overline{B}\overline{C} = \\
 &= \overline{A} + \overline{C}(1 + AB + \overline{B}) = \\
 &= \overline{A} + \overline{C} = \overline{AC}
 \end{aligned}$$



3a/

		CD			
AB		00	01	11	10
	00	1	1	1	0
	01	0	1	1	0
	11	0	1	1	0
	10	1	1	1	1

$$Y = D + \bar{B}\bar{C} + A\bar{B}$$



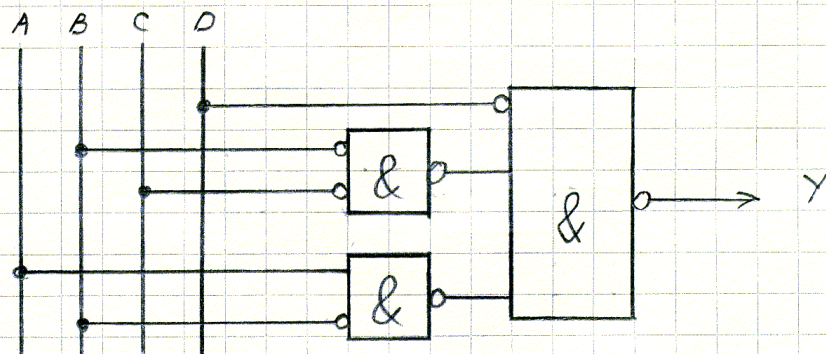
3b/

$$Y = D + \bar{B}\bar{C} + A\bar{B} =$$

$$\overline{\overline{D + \bar{B}\bar{C} + A\bar{B}}} =$$

$$\overline{\overline{D} \cdot \overline{\bar{B}\bar{C}} \cdot \overline{A\bar{B}}} =$$

$$\overline{\overline{D} \cdot B C \cdot A \bar{B}} =$$



3 c)

AB \ CD				
	00	01	11	10
00	1	1	1	0
01	0	1	1	0
11	0	1	1	0
10	1	1	1	1

$$\bar{Y} = B\bar{D} + \bar{A}C\bar{D}$$

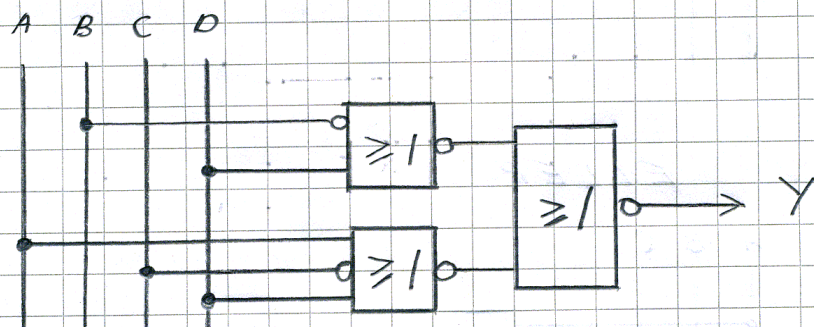
$$Y = \overline{B\bar{D} + \bar{A}C\bar{D}} =$$

$$= \overline{B\bar{D} + \bar{A}C\bar{D}} =$$

$$= \overline{B\bar{D}} \cdot \overline{\bar{A}C\bar{D}} =$$

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

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



4. $T = (Q_B \oplus Q_A) \cdot \bar{Q}_C$

$J = Q_C \cdot \bar{Q}_A$

$K = Q_A \cdot Q_C$

$D = \overline{Q_B \oplus Q_A}$

FORE CP

$Q_A \quad Q_B \quad Q_C$

T

$J \quad K$

D

AFTER CP

$Q_A^+ \quad Q_B^+ \quad Q_C^+$

0 0 0

0

0 0

1

0

0

1

0 0 1

0

1 0

1

0

1

1

0 1 0

1

0 0

0

1

1

0

0 1 1

0

1 0

0

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1

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1 0 0

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1 1 0

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0

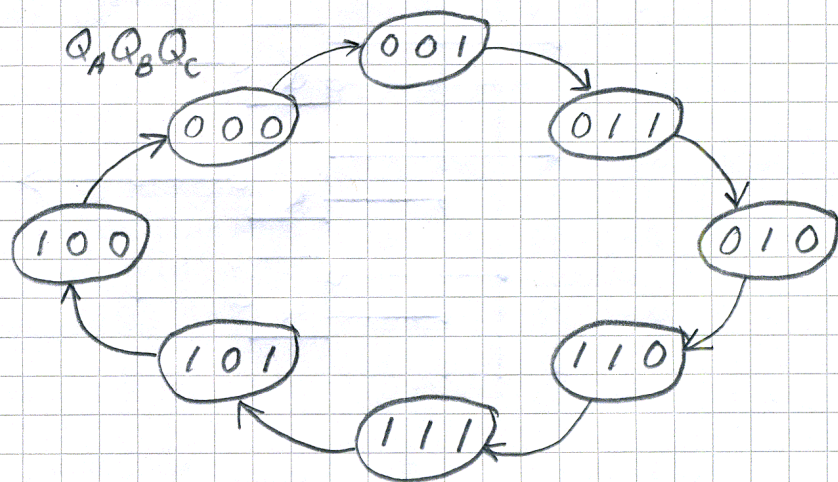
0 1

1

1

0

1



5. FORE CP

AFTER CP

X	Q _A	Q _B	S _A	R _A	S _B	R _B	Q _A ⁺	Q _B ⁺
0	0	0	0	-	0	-	0	0
0	0	1	0	-	0	1	0	0
0	1	0	-	0	1	0	1	1
0	1	1	-	0	-	0	1	1
1	0	0	1	0	0	-	1	0
1	0	1	0	-	-	0	0	1
1	1	0	-	0	0	-	1	0
1	1	1	0	1	-	0	0	1

X	Q _A Q _B	00	01	11	10
0	0	0	0	-	-
1	0	1	0	0	-

$$S_A = X \bar{Q}_B$$

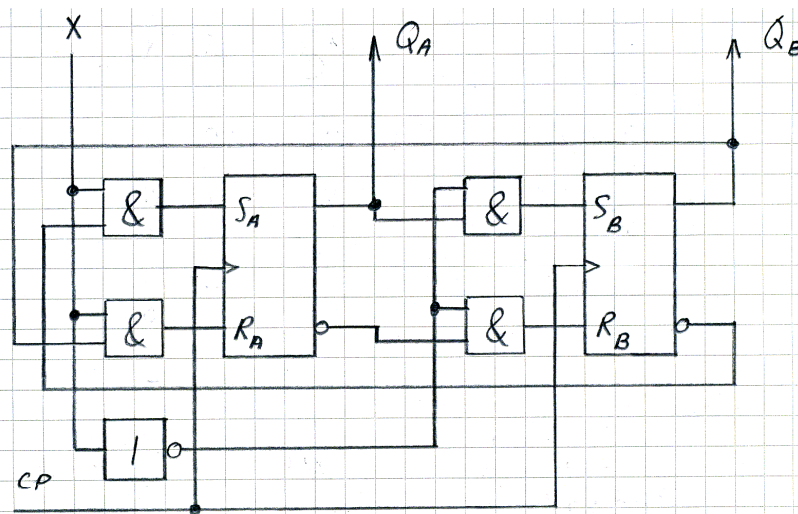
X	Q _A Q _B	00	01	11	10
0	-	-	0	0	0
1	0	1	0	1	0

$$R_A = X Q_B$$

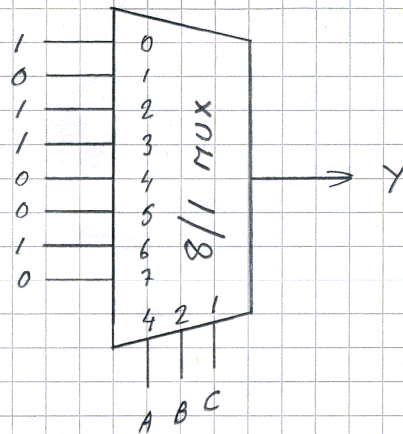
X	Q _A Q _B	00	01	11	10
0	0	0	0	1	0
1	0	1	-	-	0

$$S_B = \bar{X} Q_A$$

X	Q _A Q _B	00	01	11	10
0	1	1	0	0	0
1	-	0	0	0	-

$$R_B = \bar{X} \bar{Q}_A$$


6a)



6b)

ALT. 1. ANVÄND A OCH B SOM STYRSIGNALER

A \ BC	BC			
	00	01	11	10
0	1	0	1	1
1	0	0	0	1

$$AB = 00 \Rightarrow Y = \bar{C}$$

$$AB = 01 \Rightarrow Y = 1$$

$$AB = 10 \Rightarrow Y = 0$$

$$AB = 11 \Rightarrow Y = \bar{C}$$

ALT. 2. ANVÄND B OCH C SOM STYRSIGNALER

A \ BC	BC			
	00	01	11	10
0	1	0	1	1
1	0	0	0	1

$$BC = 00 \Rightarrow Y = \bar{A}$$

$$BC = 01 \Rightarrow Y = 0$$

$$BC = 10 \Rightarrow Y = 1$$

$$BC = 11 \Rightarrow Y = \bar{A}$$

ALT. 3. ANVÄND A OCH C SOM STYRSIGNALER

A \ BC	BC			
	00	01	11	10
0	1	0	1	1
1	0	0	0	1

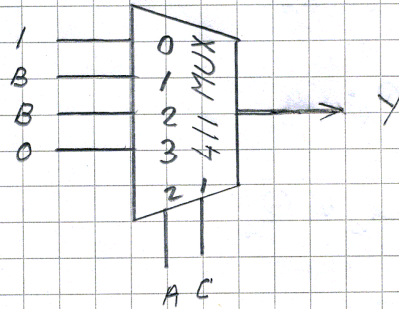
$$AC = 00 \Rightarrow Y = 1$$

$$AC = 01 \Rightarrow Y = B$$

$$AC = 10 \Rightarrow Y = B$$

$$AC = 11 \Rightarrow Y = 0$$

ALLTSA, ALT, 3 GER EN LÖSNING
UTAN INVERTERARE



6c)

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

$$\bar{Y} = A\bar{B} + AC + \bar{B}C$$

$$Y = \overline{A\bar{B} + AC + \bar{B}C} =$$

$$= \overline{A\bar{B}} \cdot \overline{AC} \cdot \overline{\bar{B}C}$$

