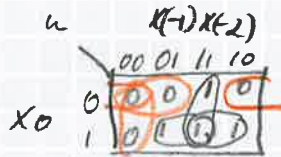


| x_0 | x_{-1} | x_{-2} | u |
|-------|----------|----------|-----|
| 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 |
| 0 | 1 | 0 | 0 |
| 0 | 1 | 1 | 1 |
| 0 | 1 | 1 | 1 |
| 1 | 0 | 0 | 0 |
| 1 | 0 | 1 | 1 |
| 1 | 1 | 0 | 1 |
| 1 | 1 | 1 | 1 |



a) $u = x(0) \cdot x(-2) + x(0) \cdot x(-1) + x(-1) \cdot x(-2)$

b) $\bar{u} = \overline{x(-1) \cdot x(-2)} + \overline{x(0) \cdot x(-1)} + \overline{x(0) \cdot x(-2)}$

$u = \overline{\overline{x(-1) \cdot x(-2)} \cdot \overline{x(0) \cdot x(-1)} \cdot \overline{x(0) \cdot x(-2)}}$

$u = (x(-1) + x(-2)) \cdot (x(0) + x(-1)) \cdot (x(0) + x(-2))$

lat: $x(0) = a$; $x(-1) = b$; $x(-2) = c$

a) $\Rightarrow u = a \cdot c + a \cdot b + b \cdot c$

$u = a \cdot c + a \cdot b + b \cdot c$

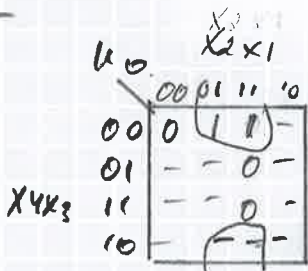
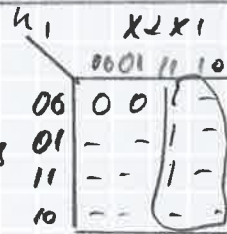
$u = \overline{\overline{a \cdot c} \cdot \overline{a \cdot b} \cdot \overline{b \cdot c}} = \overline{\overline{a \cdot c} \cdot \overline{a \cdot b} + \overline{b \cdot c}} =$

$= \overline{\overline{a \cdot c} \cdot \overline{a \cdot b} + \overline{b \cdot c}} = \overline{\overline{a \cdot c} \cdot \overline{a \cdot b}} \cdot \overline{\overline{b \cdot c}} =$

$\Rightarrow u = \overline{\overline{a \cdot c} \cdot \overline{a \cdot b}} \cdot b \cdot c$

2)

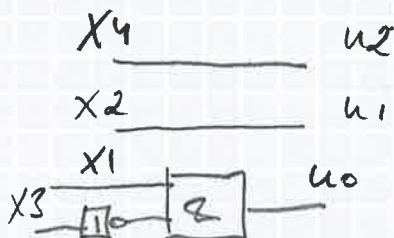
| x_4 | x_3 | x_2 | x_1 | u_2 | u_1 | u_0 |
|------------|-------|-------|-------|-------|-------|-------|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| 0 | 0 | 1 | 1 | 0 | 1 | 1 |
| 0 | 1 | 1 | 1 | 0 | 1 | 0 |
| 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| övriga --- | | | | | | |



$u_2 = x_4$

$u_1 = x_2$

$u_0 = \overline{x_3} \cdot x_1$



3)

| | 89_{10} | Σ |
|-----|-----------|----------|
| 1 | 1 | 89 |
| 2 | 0 | 88 |
| 4 | 0 | 88 |
| 8 | 1 | 88 |
| 16 | 1 | 80 |
| 32 | 0 | 64 |
| 64 | 1 | 64 |
| 128 | 0 | |

| | 80 | Σ |
|-----|----|----------|
| 1 | 0 | |
| 2 | 0 | |
| 4 | 0 | |
| 8 | 0 | |
| 16 | 1 | 80 |
| 32 | 0 | |
| 64 | 1 | |
| 128 | | |

a) $89_{10} = 01011001_2$

b) $89_{10} = 59_{16}$

c) $89_{10} = 131_D$

d) $89_{10} = 1121_4$

e) $2 \cdot 89_{10} = 201011001 = 10100110 + 10100111$

Svar: 10100111_2

f) $01010000_2 + 10100111_2 \Rightarrow$

$$\begin{array}{r} 01010000 \\ + 10100111 \\ \hline 11110111 \end{array}$$
 negativ!

$$\begin{array}{r} 11110111 \\ \sim 00001000 \\ \hline 00001001_2 \end{array}$$

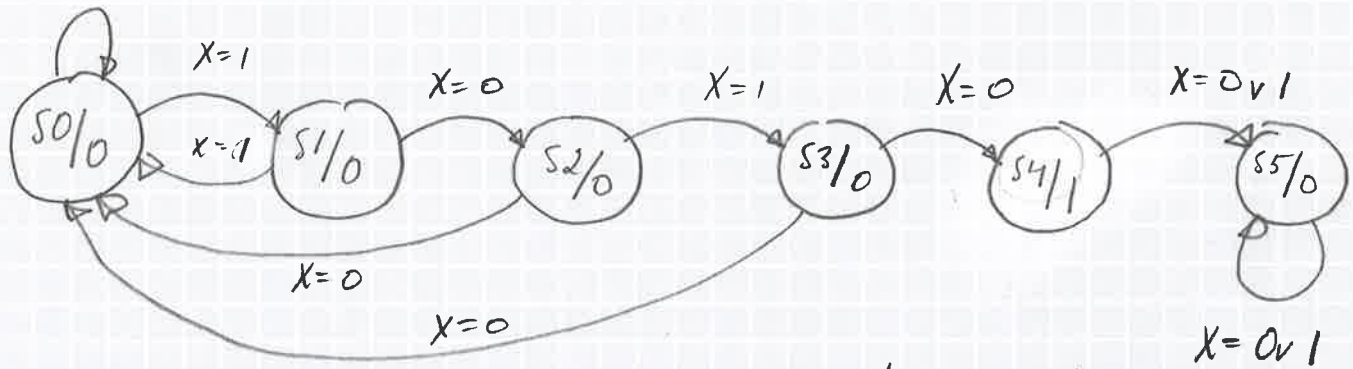
Svar: $-00001001_2 = -9_{10}$

g)

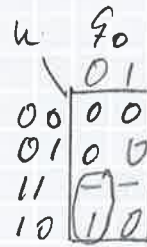
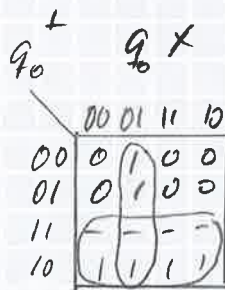
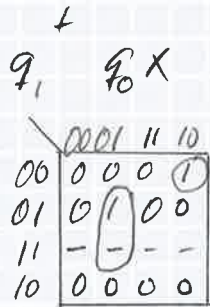
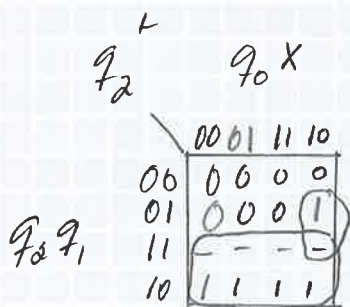
Max: $01111111_2 = 128 - 1 = 127_{10}$

Min: $10000000 = -128_{10}$

4/ $X=0$



| Nuv | Nästa | | | $q_2 q_1 q_0$ | | | |
|-----|-------|-----|---|---------------|-----|-----|---|
| | X=0 | X=1 | u | $q_2 q_1 q_0$ | X=0 | X=1 | u |
| S0 | S0 | S1 | 0 | 000 | 000 | 001 | 0 |
| S1 | S2 | S0 | 0 | 001 | 010 | 000 | 0 |
| S2 | S0 | S3 | 0 | 010 | 000 | 011 | 0 |
| S3 | S4 | S0 | 0 | 011 | 100 | 000 | 0 |
| S4 | S5 | S5 | 1 | 100 | 101 | 101 | 1 |
| S5 | S5 | S5 | 0 | 101 | 101 | 101 | 0 |



$$q_2^+ = q_2 + q_1 \cdot q_0 \cdot \bar{X}$$

$$q_1^+ = q_1 \cdot \bar{q}_0 \cdot X + \bar{q}_2 \cdot \bar{q}_1 \cdot q_0 \cdot \bar{X}$$

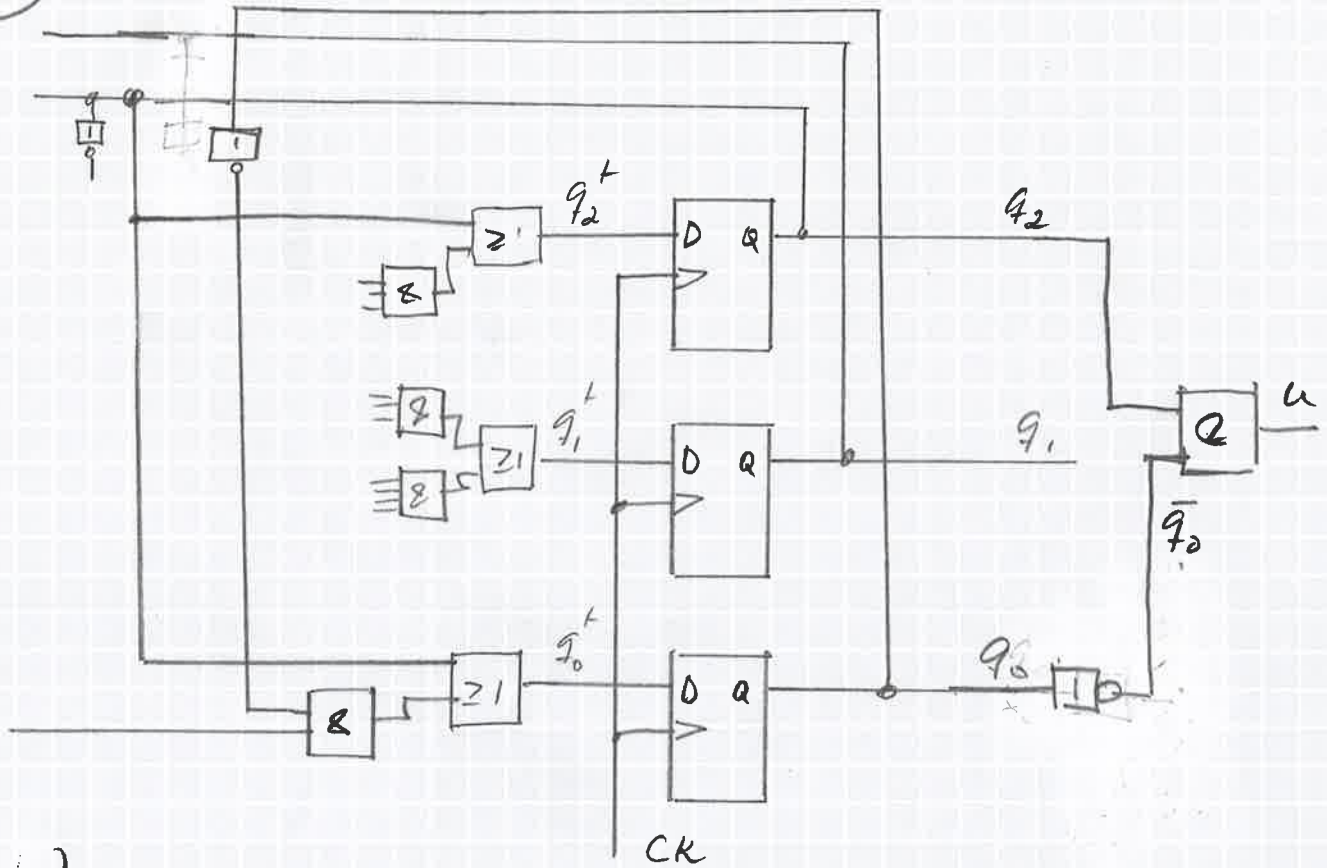
$$u = q_2 \cdot \bar{q}_0$$

$$q_0^+ = q_0 + \bar{q}_0 \cdot X$$

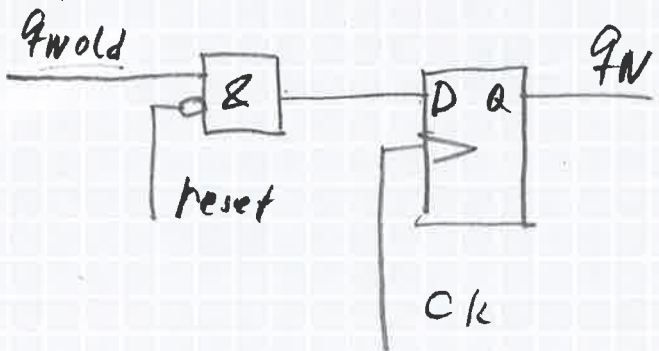
Ua+b)

Teutamen '11-16

bid 4.



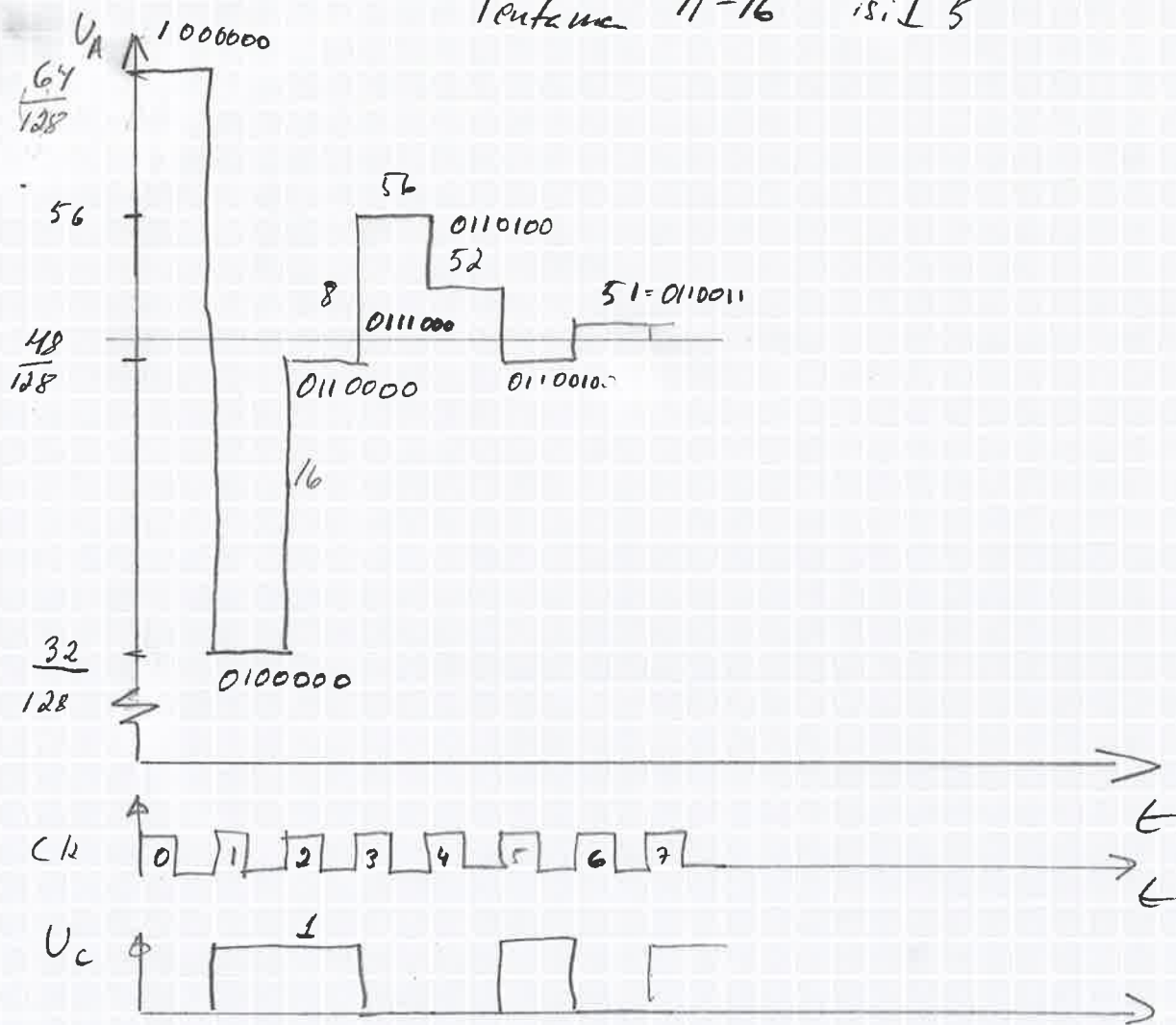
c) Eftersom vid reset alla vipporna skall
 + nollställas så skall $D = q_n^+ = 0 \Rightarrow$



Där $N = 0, 1, 2$

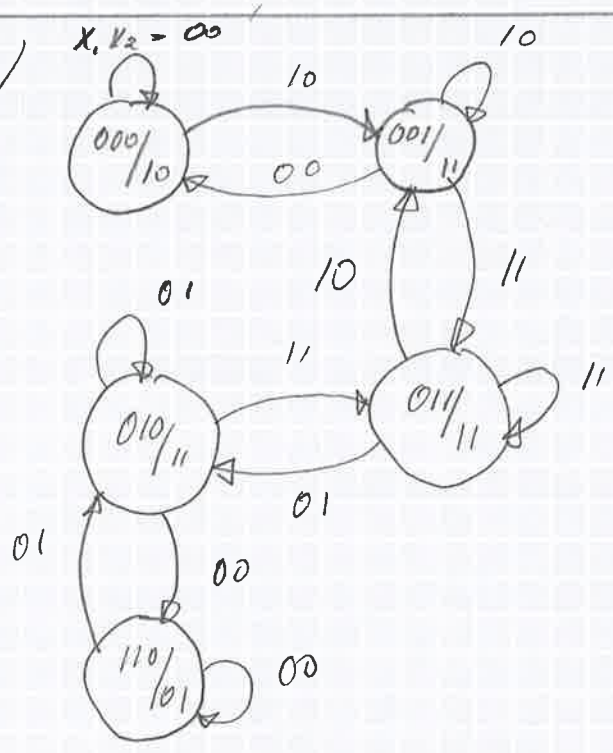
Tentamen 11/1-16 18:15

6)



Svar: 0110011 eller 0110010 (612)

7)



7/ forts

| $q_2 q_1 q_0$ | $x_1 x_2$ | $x_1 x_2$ | $x_1 x_2$ | $x_1 x_2$ | $y_1 y_2$ |
|---------------|-----------|-----------|-----------|-----------|-----------|
| $q_2 q_1 q_0$ | 00 | 01 | 10 | 11 | |
| 000 | 000 | --- | 001 | --- | 10 |
| 001 | 000 | --- | 001 | 011 | 11 |
| 010 | 110 | 010 | --- | 011 | 11 |
| 011 | --- | 010 | --- | 011 | 11 |
| 100 | --- | --- | --- | --- | --- |
| 101 | --- | --- | --- | --- | --- |
| 110 | 110 | 010 | --- | --- | 01 |
| 111 | --- | --- | --- | --- | --- |

$q_2 q_1$

q_2^+

| | |
|----|-----------|
| | $q_0 x_1$ |
| 00 | 0000 |
| 01 | 1--- |
| 11 | 1--- |
| 10 | --- |

$x_2 = 0$
 $q_2^+ = q_1 \cdot \overline{x_2}$

q_2^+

| | |
|----|-----------|
| | $q_0 x_1$ |
| 00 | ---0 |
| 01 | 0000 |
| 11 | 0--- |
| 10 | --- |

$x_2 = 1$

q_1^+

| | |
|----|-----------|
| | $q_0 x_1$ |
| 00 | 0000 |
| 01 | 1--- |
| 11 | 1--- |
| 10 | --- |

$x_2 = 0$
 $q_1^+ = q_1 + x_2$

q_1^+

| | |
|----|-----------|
| | $q_0 x_1$ |
| 00 | ---1 |
| 01 | 1111 |
| 11 | 1--- |
| 10 | --- |

$x_2 = 1$

$q_2 q_1$

q_0

| | |
|----|-----------|
| | $q_0 x_1$ |
| 00 | 0000 |
| 01 | 0--- |
| 11 | 0--- |
| 10 | --- |

$x_2 = 0$
 $q_0^+ = x_2 \cdot x_1$

q_0

| | |
|----|-----------|
| | $q_0 x_1$ |
| 00 | ---1 |
| 01 | 0110 |
| 11 | 0--- |
| 10 | --- |

$x_2 = 1$

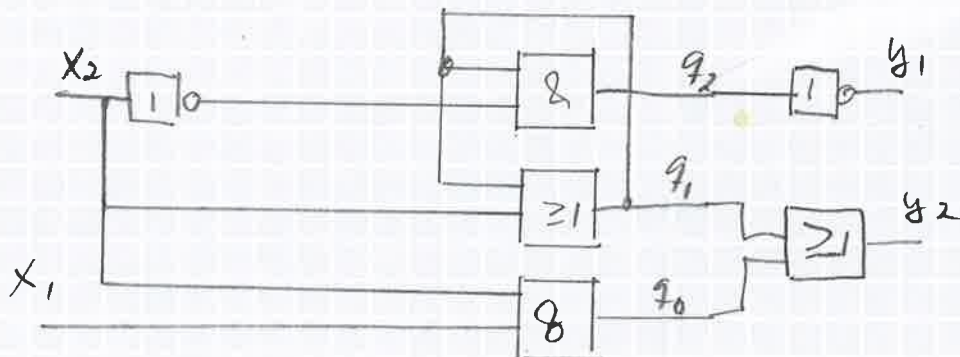
y_1

| | |
|----|-------|
| | q_0 |
| 00 | 11 |
| 01 | 11 |
| 11 | 0- |
| 10 | --- |

y_2

| | |
|----|-------|
| | q_0 |
| 00 | 011 |
| 01 | 11 |
| 11 | 1- |
| 10 | --- |

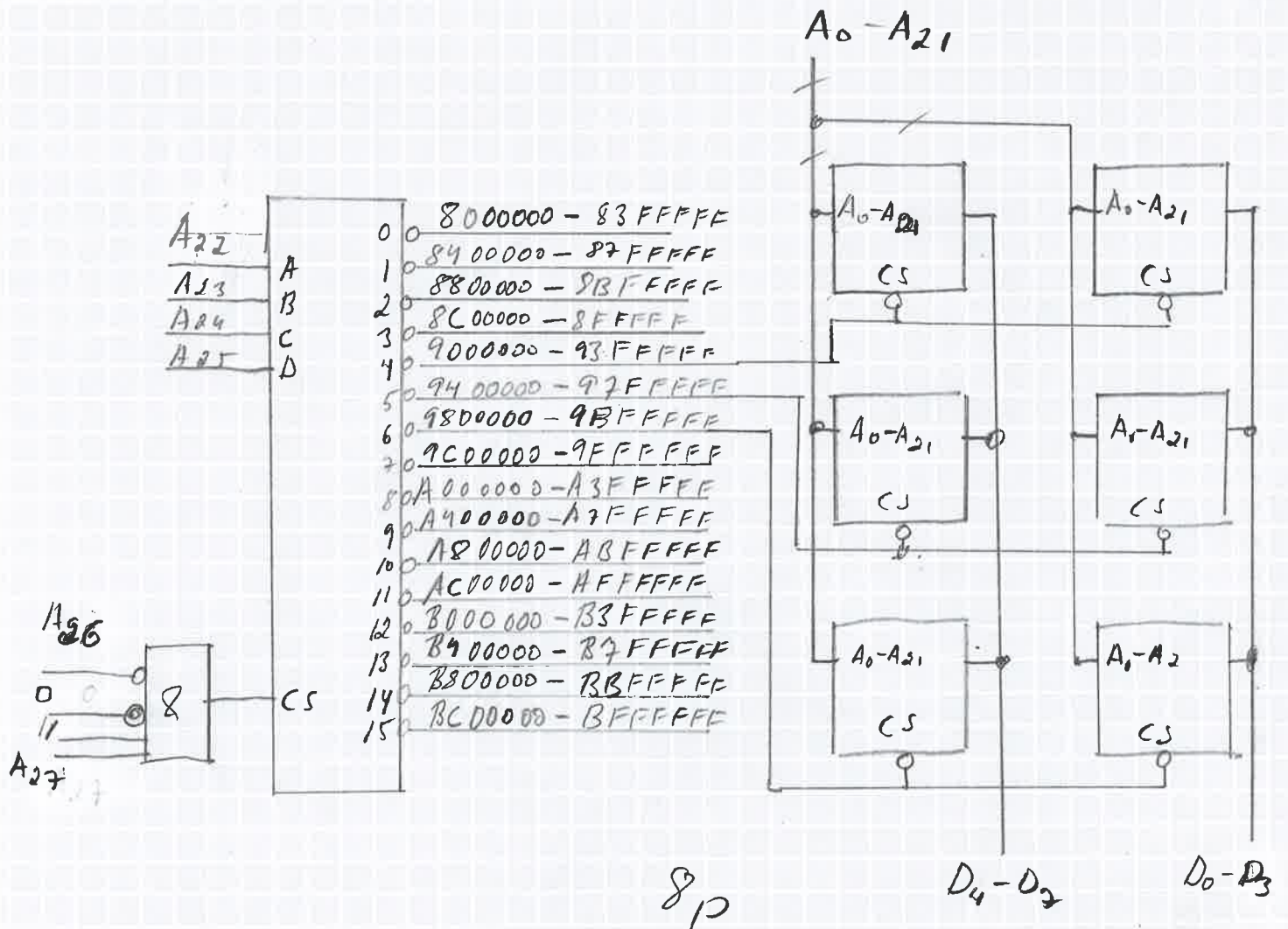
$y_1 = \overline{q_2}$ $y_2 = q_1 + q_0$



(8p)

8)

| A ₂₇ | A ₂₆ | A ₂₅ | A ₂₄ | A ₂₃ | A ₂₂ | A ₂₁ | A ₂₀ | A ₁₉ | A ₁₈ | A ₁₇ | A ₁₆ | A ₁₅ | A ₁₄ | A ₁₃ | A ₁₂ | A ₁₁ | A ₁₀ | A ₉ | A ₈ | A ₇ | A ₆ | A ₅ | A ₄ | A ₃ | A ₂ | A ₁ | A ₀ | | |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|---|----------|
| 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9000000 |
| 1 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 9BFFFFFF |
| 1 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 93FFFFFF |
| 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9400000 |
| 1 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 97FFFFFF |
| 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | BFFFFFFF |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8000000 |



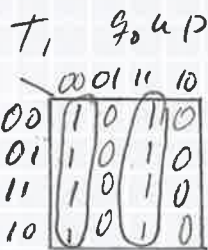
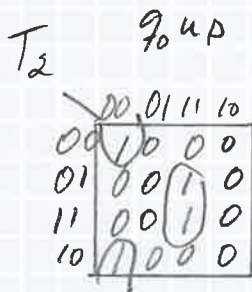
8/p

5) a+b

Tentamen 11-16

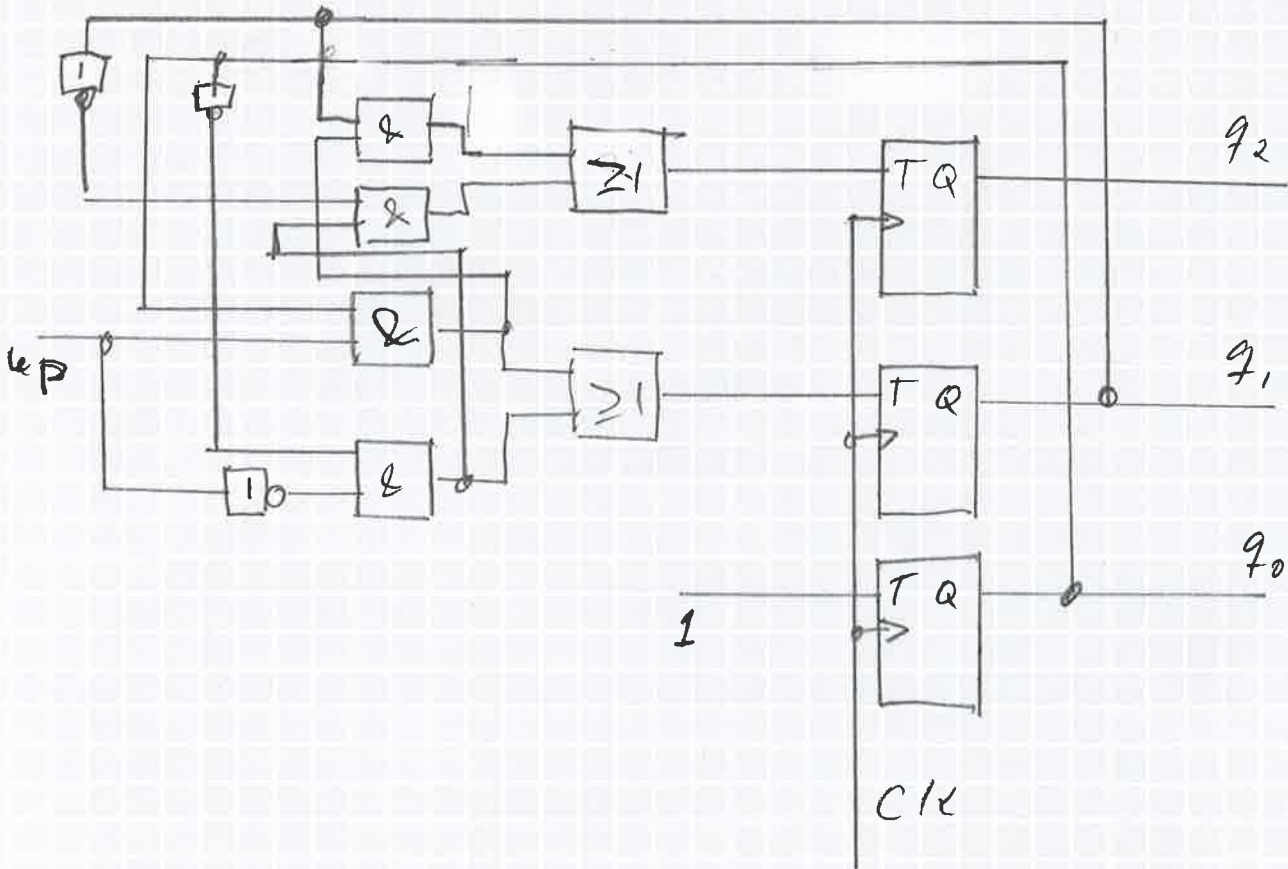
| $q_2 q_1 q_0$ | $q_2^+ q_1^+ q_0^+$ | | $T_2 T_1 T_0$ | |
|---------------|---------------------|------|---------------|------|
| | up=0 | up=1 | up=0 | up=1 |
| 000 | 111 | 001 | 111 | 001 |
| 001 | 000 | 010 | 001 | 011 |
| 010 | 001 | 011 | 011 | 001 |
| 011 | 010 | 100 | 001 | 111 |
| 100 | 011 | 101 | 111 | 001 |
| 101 | 100 | 110 | 001 | 011 |
| 110 | 101 | 111 | 011 | 001 |
| 111 | 110 | 000 | 001 | 111 |

$T_0 = 1$



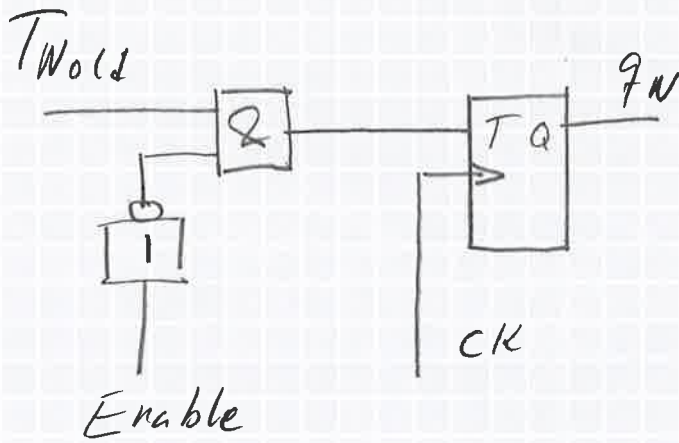
$$T_2 = \overline{q_1} \cdot \overline{q_0} \cdot \overline{up} + q_1 \cdot q_0 \cdot up$$

$$T_1 = \overline{q_0} \cdot \overline{up} + q_0 \cdot up$$



c)

Eftersom $T=0$ ger att $q^+ = q$,
 så kan vi komplettera varje vippa med



där $N=0,1,2$

T_{Nold} är lösningen
 i upps. a+b