Exam 25 January 25.1.16, questions and answers

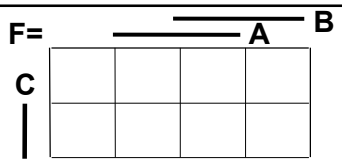
Logic Systems And Processors (České Vysoké Učení Technické v Praze)

Surname and first name:.....

Exam 25.1.2016 - write here only your answers

1. Rewrite the logical expression F so that not operators were only before variables - check your solution in K-map!

F = not ((A or not B or not C) or ((A or B) and not (A or not C)))



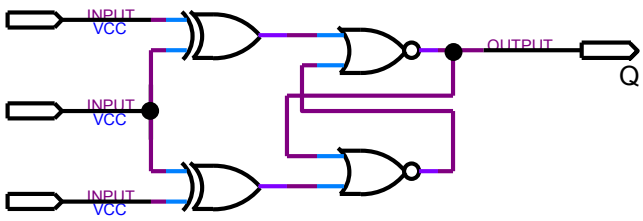
F =.....

2. Inputs A, B, C have values shown in the figure in times t_0, t_1, t_2, t_3 . Write values of X and Y outputs. Assume that the intervals between changes in the inputs are so long so we can neglect delays of gates.

A = ..0..|..1..|..1..|..1..|..1..|
t_0..|..t_1..|.. t_2..|..t_3..|..

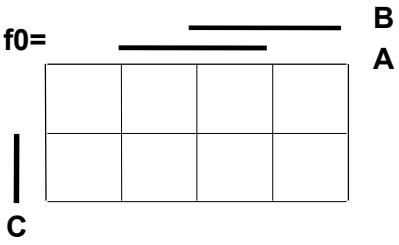
B = ..0..|..0..|..0..|..0..|..1..|
t_0..|..t_1..|.. t_2..|..t_3..|..

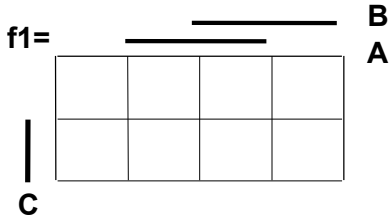
C = ..1..|..1..|..0..|..0..|



Q = ...|.....|.....|.....|
t_0..|..t_1..|..t_2..|..t_3..|..

3. Function Q=f(A,B,C, Q) from question 2, decompose into X= (not X and f0(A, B,C)) or (X and f1(A,B,C)) with the aid of **Shannon's expansion. Write f0 and f1 functions as Karnaugh maps:**





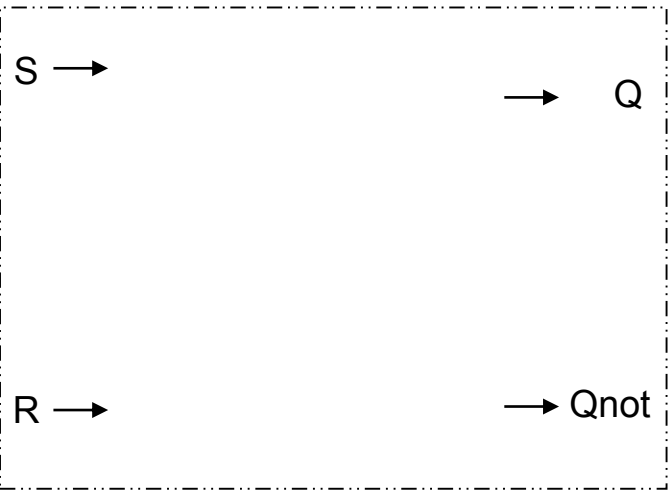
4. What decimal value is 10-bit number 10 0000 1111 if we interpret it as an integer

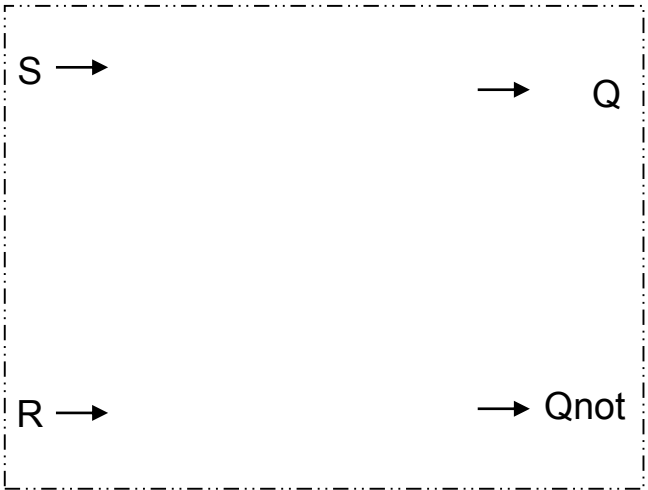
a) unsigned ..... b) signed in two's-complement..... ...

5. Mark all logic functions that have another equivalent logic function here *:*

f1<=(A xor C) or (A and not C); f1 ☐
f2<=(B or C) and (not A or B or C); f2 ☐
f3<=((C and not B) or (B and A)); f3 ☐
f4<=(A or C) and (not A or not C); f4 ☐
f5<=(A and not B) xor (A and C); f5 ☐
f6<=(A and not C) or (C and not A); f6 ☐

5. Draw R-S latch only from NOR gates and the same only from NAND gates





Zde nepište

3

5

f0/3

f1/3

2

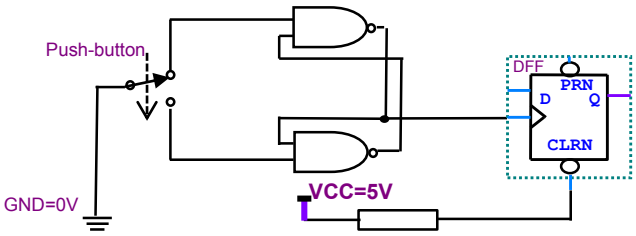
4

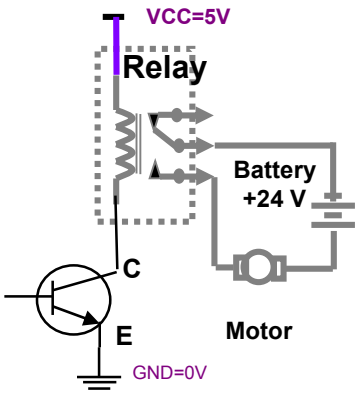
3/Nand

3/nor

Part 1
26

7. One student came to an exam just to try it. Complete his non-functioning schematic - the motor is switched on by the push-button, and switched off by pressing it again. After powering up, the motor must be in stop mode. Help: You should add
7 additional elements to finish schematics.





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8. *An editor **ask you if you could analyze wrong formatted VHDL code:***

```
library IEEE; use IEEE.STD_LOGIC_1164.all;
entity test20140214 is port (a, b, c, d : in std_logic; e : out std_logic); end;
architecture rtl of test20140214 is begin
   process(a, b) variable z:std_logic_vector(0 to 3); begin
   if b = '0' then z:=(others=>'0'); elsif rising_edge(a) then
   if c='1' then z:=d & & z(0 to 2); else z:=z(3) & z(0 to 2); end if; end if; e<=z(3); end process; end rtl;
```

Draw a logical circuit diagram corresponding to this VHDL code and give it appropriate title that describes its function. Guide: First, rewrite this program in the correct formatting.

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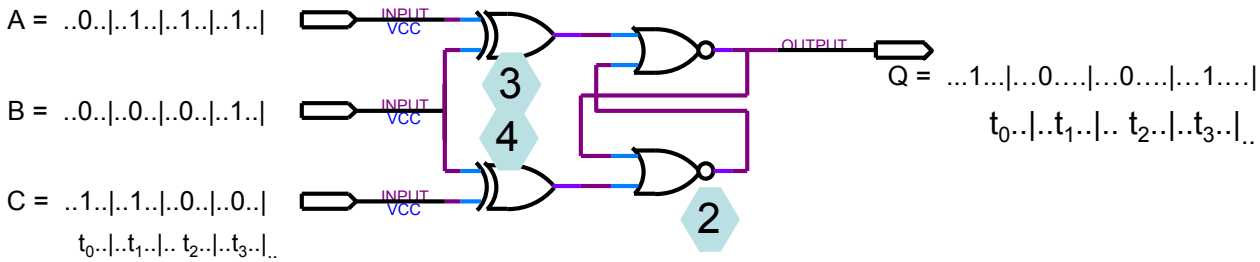
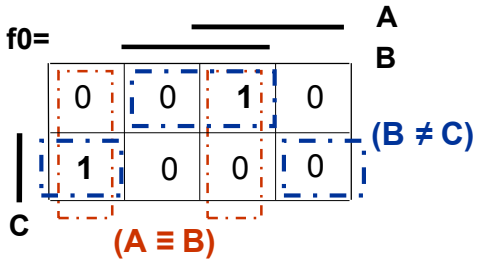
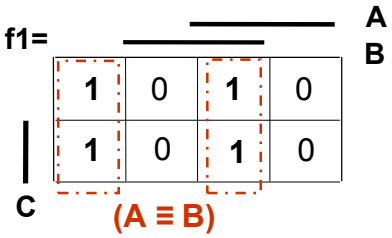


f0 := f(A,B,C,'0') := (A ≡ B) . ('0' + (B ≠ C)) := (A ≡ B) . ('0' + (B ≠ C)):= **(A ≡ B) . (B ≠ C)**

f1 := f(A,B,C,'1') := (A ≡ B) . ('1' + (B ≠ C)) := (A ≡ B) . '1' := **(A ≡ B)**

*Obě nalezené funkce f0:=***(A ≡ B) . (B ≠ C)** a *f1:=***(A ≡ B)** *zapíšeme jako Karnoughovy mapy*





5. Mark all logic functions that have another equivalent logic function here *:*

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f2<=(B or C) and (not A or B or C);
f3<=((C and not B) or (B and A));
f4<=(A or C) and (not A or not C);
f5<=(A and not B) xor (A and C);
f6<=(A and not C) or (C and not A);

f1 ■
f2 □
f3 □
f4 ■
f5 □
f6 ■