Lösningsförslag till dugga 2 i TMEL53 Digitalteknik 2016-02-03

1a) $\bar{x}_2 + x_3\bar{x}_1 =$

$= \bar{x}_2(x_1+\bar{x}_1)(x_3+\bar{x}_3) + x_3\bar{x}_1(x_2+\bar{x}_2) =$

$= (\bar{x}_2x_1 + \bar{x}_2\bar{x}_1)(x_3+\bar{x}_3) + x_3\bar{x}_1x_2 + x_3\bar{x}_1\bar{x}_2 =$

$= \underbrace{x_3\bar{x}_2x_1}_{P_5} + \underbrace{\bar{x}_3\bar{x}_2x_1}_{P_1} + \underbrace{x_3\bar{x}_2\bar{x}_1}_{P_4} + \underbrace{\bar{x}_3\bar{x}_2\bar{x}_1}_{P_0} +$

$+ \underbrace{x_3x_2\bar{x}_1}_{P_6} + \underbrace{x_3\bar{x}_2\bar{x}_1}_{P_4} = / P_4 + P_4 = P_4 / =$

$= \underbrace{\bar{x}_3\bar{x}_2\bar{x}_1}_{P_0} + \underbrace{\bar{x}_3\bar{x}_2x_1}_{P_1} + \underbrace{x_3\bar{x}_2\bar{x}_1}_{P_4} + \underbrace{x_3\bar{x}_2x_1}_{P_5} + \underbrace{x_3x_2\bar{x}_1}_{P_6}$

1b) P_2, P_3 OCH P_7 SAKNAS I SP NORMALFORMEN OVAN.

→ PS NORMALFORMEN BLIR ALLTSÅ:

$\bar{x}_2 + x_3\bar{x}_1 = S_2 \cdot S_3 \cdot S_7 =$

$= \underbrace{(x_3 + \bar{x}_2 + x_1)}_{S_2}\underbrace{(x_3 + \bar{x}_2 + \bar{x}_1)}_{S_3}\underbrace{(\bar{x}_3 + \bar{x}_2 + \bar{x}_1)}_{S_7}$

2a) $F = (A \oplus C) + \bar{B} + BC\bar{D} + \overline{ACD}$

A	B	C	D	$A \oplus C$	$\bar{B}$	$BC\bar{D}$	$\overline{ACD}$	F
0	0	0	0	0	1	0	1	1
0	0	0	1	0	1	0	1	1
0	0	1	0	1	1	0	1	1
0	0	1	1	1	1	0	1	1
0	1	0	0	0	0	0	1	1
0	1	0	1	0	0	0	1	1
0	1	1	0	1	0	1	1	1
0	1	1	1	1	0	0	1	1
1	0	0	0	1	1	0	1	1
1	0	0	1	1	1	0	1	1
1	0	1	0	0	1	0	1	1
1	0	1	1	0	1	0	0	1
1	1	0	0	1	0	0	1	1
1	1	0	1	1	0	0	1	1
1	1	1	0	0	0	1	1	1
1	1	1	1	0	0	0	0	0

2b) DET ENKLASTE ÄR ATT TITTA I FUNKTIONSTABELLEN. DÅ SER MAN ATT $F = 0$ OM $A=1$ OCH $B=1$ OCH $C=1$ OCH $D=1$,

DVS $\bar{F} = ABCD \Rightarrow F = \overline{ABCD}$

OM MAN ANVÄNDER KARNAUGH-DIAGRAM OCH RINGAR IN 0:OR SÅ GER DET SAMMA SAK. OM MAN RINGAR IN 1:OR SÅ FÅR KARNAUGHDIAGRAMMET FÖLJANDE UTSEENDE :

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

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

DE MORGANS TEOREM $\Rightarrow$

$$F = \overline{ABCD}$$

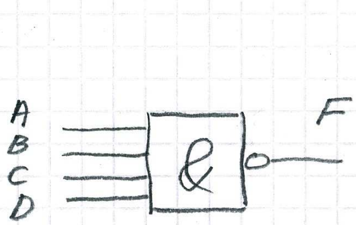
OM MAN DÄREMOT JOBBAR MED BOOLESK ALGEBRA SÅ MEDFÖR DET EN STÖRRE ARBETSINSATS:

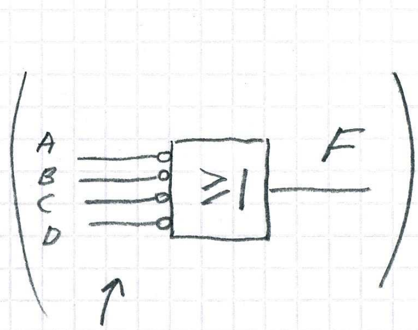
$$F = (A \oplus C) + \bar{B} + BC\bar{D} + \overline{ACD} =$$

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

$$= \bar{A}(C+1) + \bar{B} + \bar{C}(A+1) + \bar{D}(BC+1) =$$

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





BILLIGARE

DYRARE PGA INVERTERARNA

3a) NAND-GRINDAR → RINGA 1:OR

A = 0

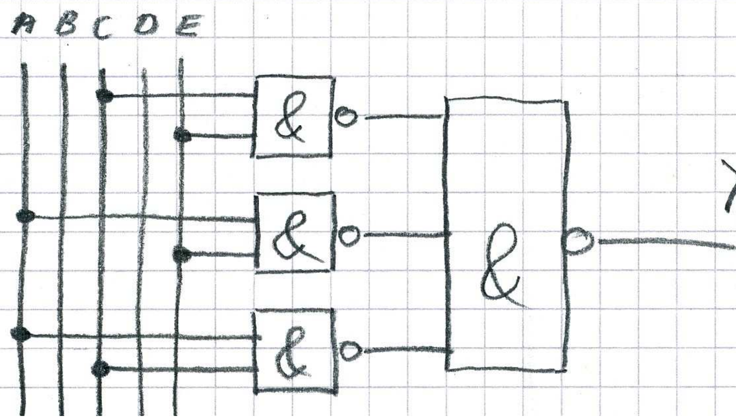
BC \ DE	00	01	11	10
00	0	0	0	0
01	0	1	1	0
11	0	1	1	0
10	0	0	0	0

A = 1

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

$$Y = CE + AE + AC =$$

$$= \overline{\overline{CE + AE + AC}} = \overline{\overline{CE} \cdot \overline{AE} \cdot \overline{AC}}$$



3b) NOR-GRINDAR ⇒ Ringa 0:or

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

$$\overline{Y} = \bar{A}\bar{C} + \bar{A}\bar{E} + \bar{C}\bar{E} \Rightarrow$$

$$Y = \overline{\bar{A}\bar{C} + \bar{A}\bar{E} + \bar{C}\bar{E}} =$$

$$= (A+C)(A+E)(C+E) =$$

$$= \overline{\overline{(A+C)(A+E)(C+E)}} =$$

$$= \overline{\overline{(A+C)} + \overline{(A+E)} + \overline{(C+E)}}$$