2015-02-04

Linköpings universitet
INSTITUTE OF TECHNOLOGY

ISY/Datorteknik

Dugga 2: Boolesk algebra och kombinatoriska nät

För godkänt på duggan krävs minst 7 poäng av 10 möjliga.

1. Konstruera ett kombinatoriskt nät med valfria grindar som fungerar enligt vidstående sanningstabell. För full poäng får max två grindar användas.

(4 p)

A	*B*	*C*	*D*	*E*	*F*
0	0	0	0	0	0
0	0	0	0	1	1
0	0	0	1	0	0
0	0	0	1	1	1
0	0	1	0	0	1
0	0	1	0	1	0
0	0	1	1	0	1
0	0	1	1	1	0
0	1	0	0	0	0
0	1	0	0	1	1
0	1	0	1	0	0
0	1	0	1	1	1
0	1	1	0	0	1
0	1	1	0	1	0
0	1	1	1	0	1
0	1	1	1	1	0
1	0	0	0	0	1
1	0	0	0	1	1
1	0	0	1	0	1
1	0	0	1	1	1
1	0	1	0	0	1
1	0	1	0	1	1
1	0	1	1	0	1
1	0	1	1	1	1
1	1	0	0	0	1
1	1	0	0	1	1
1	1	0	1	0	1
1	1	0	1	1	1
1	1	1	0	0	1
1	1	1	0	1	1
1	1	1	1	0	1
1	1	1	1	1	1

2a) Rita grindnäten för $Y_1 = B\left(\left(\overline{A \oplus C}\right) + CD\right)$ och $Y_2 = \overline{\overline{B} + A\overline{C} + \overline{A}C\overline{D}}$. (3 p)

2b) Visa att $Y_2 = Y_1$. (3 p)

Boolesk algebra

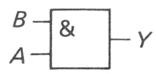
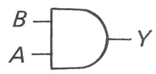
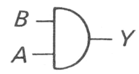
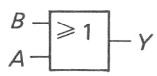
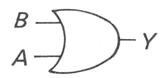
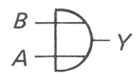
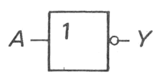
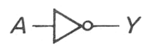
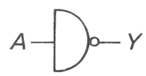
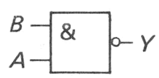
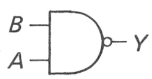
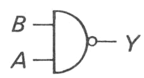
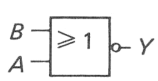
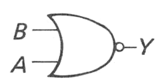
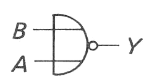
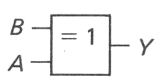
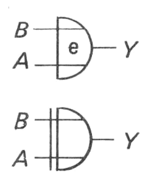
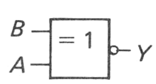
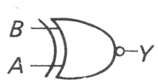
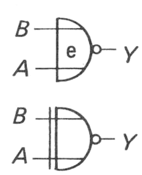
Satser för en variabel:

$$A + A = A$$
$$A \cdot A = A$$
$$A + \overline{A} = 1$$
$$A \cdot \overline{A} = 0$$
$$A + 1 = 1$$
$$A \cdot 0 = 0$$
$$A + 0 = A$$
$$A \cdot 1 = A$$
$$\overline{\overline{A}} = A$$

Satser för flera variabler:

$A + (B + C) = (A + B) + C$	Associativa
$A(BC) = (AB)C$	lagarna
$A + B = B + A$	Kommutativa
$AB = BA$	lagarna
$A(B + C) = AB + AC$	Distributiva
$A + (BC) = (A + B)(A + C)$	lagarna
$A + AB = A$	Absorptions-
$A(A + B) = A$	lagarna
$\overline{A}B + AC = \overline{A}B + AC + BC$	Consensus-
$(\overline{A} + B)(A + C) = (\overline{A} + B)(A + C)(B + C)$	lagarna
$\overline{A + B} = \overline{A} \cdot \overline{B}$	de Morgans
$\overline{A \cdot B} = \overline{A} + \overline{B}$	lagar
$A \oplus B = A\overline{B} + \overline{A}B$	Omskrivning av EXOR
$\overline{A \oplus B} = AB + \overline{A}\,\overline{B}$	Omskrivning av EXNOR

Sammanställning av grindar som förekommer inom digitaltekniken

Funktion	Symbol: IEC	Symbol: Amerikansk	Symbol: Äldre svensk	Funktions-tabell	Logiskt uttryck
OCH AND				A B | Y 0 0 | 0 0 1 | 0 1 0 | 0 1 1 | 1	$Y = A\,B$ $Y = A \wedge B$
ELLER OR				A B | Y 0 0 | 0 0 1 | 1 1 0 | 1 1 1 | 1	$Y = A + B$ $Y = A \vee B$
ICKE NOT				A | Y 0 | 1 1 | 0	$Y = \bar{A}$
NAND				A B | Y 0 0 | 1 0 1 | 1 1 0 | 1 1 1 | 0	$Y = \overline{AB}$
NOR				A B | Y 0 0 | 1 0 1 | 0 1 0 | 0 1 1 | 0	$Y = \overline{A + B}$
Exklusivt- ELLER Exclusive-OR EXOR				A B | Y 0 0 | 0 0 1 | 1 1 0 | 1 1 1 | 0	$Y = A \oplus B$
Exklusivt- NOR Exclusive-NOR EXNOR				A B | Y 0 0 | 1 0 1 | 0 1 0 | 0 1 1 | 1	$Y = \overline{A \oplus B}$