İTÜ
Computer Engineering Department
Assist. Prof. Feza BUZLUCA
Asist.Prof. Mustafa Ersel KAMAŞAK
15 Jan. 2012

DIGITAL CIRCUTIS FINAL EXAM SOLUTIONS (Question 1)

QUESTION 1 (20 Points):

f(A,B,C,D)=A’B’CD+AB’CD+AC’D+AC’D’+A’B’CD’+ABCD+ACD’

=(A’+A)B’CD + AC’(D+D’) + A’B’CD’ + ABCD + ACD’ (Inverse)

=(B’+AB)CD + AC’ + A’B’CD’ + ACD’ (absorbtion)

= B’CD + A(CD + C’) + (A’B’+A) CD’ (absorbtion)

= B’CD + AD + AC’ + B’CD’ + ACD’

= B’CD + AD + B’CD’ + A(C’+CD’) (absorbtion)

= B’CD + AD + B’CD’ + AC’ + AD’

= B’C(D + D’) + A(D+C’+D’) (inverse)

= B’C + A

b)

f: AB \ CD	00	01	11	10
00	1	1	1	1
01	0	0	0	1
11	Φ	0	Φ	1
10	1	1	1	1

By considering 0 and Φ points we can obtain complement of f.

$\bar{f} = B\bar{C} + BD$

De Morgan:

$f = \overline{B\bar{C} + BD} = \overline{B\bar{C}} \cdot \overline{BD}$

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

Or by considering true (1) points:

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

Distributive Law:

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

DIGITAL CIRCUTIS FINAL EXAM (Question 2)

QUESTION 2 (40 Points):

a.

Z: AB \ CD	00	01	11	10
00	1	0	1	1
01	1	1	1	0
11	Φ	0	0	0
10	1	0	1	1

Set of all prime implicants:

$\bar{C}\bar{D}$, $\bar{B}C$, $\bar{B}\bar{D}$, $\bar{A}B\bar{C}$, $\bar{A}BD$, $\bar{A}CD$

A B C D E F

b. **Prime Implicant Chart:**

		0	2	3	4	5	7	8	10	11	Cost
√	A	X			X			X			6
√	B		X	X					X	X	5
	C	X	X					X	X		6
	D				X	X					8
√	E					X	X				7
	F			X			X				7

c.

Cheapest sufficient set of prime implicants:

A + B + E: Cost=18

Cheapest expression: $Z = \bar{C}\bar{D} + \bar{B}C + \bar{A}BD$

QUESTION 3

a) $Q_1^+ = A\bar{Q}_1 + \bar{B}Q_1$

$Q_0^+ = 1 \oplus Q_0 = \bar{Q}_0$

$Z = \bar{s}_1 s_0 + s_1 \bar{s}_0$

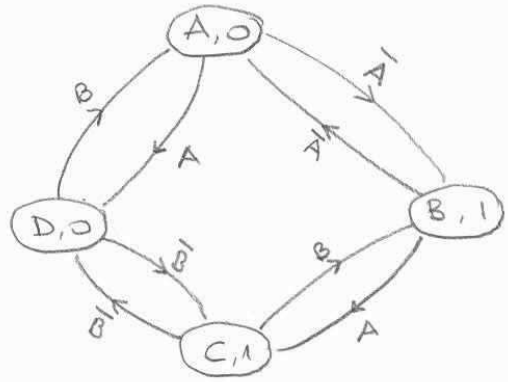
$= s_1 \oplus s_0 = Q_1 \oplus Q_0$

Output is a function of states $\longrightarrow$ Moore Model

$Q_1^+ Q_0^+$

Q_1Q_0 \ AB	00	01	10	11	Z
00	01	01	11	11	0
01	00	00	10	10	1
10	11	01	11	01	1
11	10	00	10	00	0

A: 00
B: 01
C: 10
D: 11



b) $Q_1^+ = D_1 = A\bar{Q}_1 + \bar{B}Q_1$

$Q_0^+ = D_0 = \bar{Q}_0$

$Z = Q_1 \oplus Q_0$