Faculty of Engineering

ELECTRICAL AND ELECTRONIC ENGINEERING DEPARTMENT

EENG115/INFE115 Introduction to Logic Design

EENG211/INFE211 Digital Logic Design I

Fall 2010-11

Instructors:

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Midterm EXAMINATION

Nov. 09, 2010

Duration: 100 minutes

Number of Problems: 6

Good Luck

STUDENT'S	
NUMBER	
NAME	SOLUTIONS
SURNAME	
GROUP NO	

Problem	Achieved	Maximum
1		15
2		15
3		10
4		20
5		20
6		20
TOTAL		100

Question 1 (15 points)

a. Convert the following decimal number, 27.03125_{10}, to octal and hexadecimal. (7 pts.)

Integer	Remainder
27	
3	3
0	3

$$27_{10}=33_8$$

	Coefficient
$0.03125 \times 8 = 0.25$	0
$0.25 \times 8 = 2.0$	2

$0.03125_{10}=0\ .02_8$

$27.03125_{10}=33.02_8 \quad \Rightarrow 011\ 011.000\ 010 \ \Rightarrow\ 1B.08_{16}$

b. Convert the following hexadecimal number, 32.125_{16} to binary and octal. (8 pts.)

$32.125_{16} = 00110010.000100100101_2 = 062.0445_8$

Question 2 (15 points):

a) Find the (*r*-1)'s and *r*'s complements of the following numbers in the indicated bases. (15 pts.)

i. $(2556)_8$

7's complement : 5221
8's complement : 5222

ii. $(10101011)_2$

1's complement: 01010100
2's complement: 01010101

iii. $(62451)_7$

6's complement : 04215
7's complement: 04216

Question 3 (10 points):

a) Generate the dual and the complement of the following functions:

i) $ABC + A'B + A(B' + C) + A'BC'$

Dual : (A+B+C)(A'+B)(A+B'C)(A'+B+C')
Complement: (A'+B'+C')(A+B')(A'+BC')(A+B'+C)

ii) $x\omega'(y' + z') + xy'(z + x'yz)$

dual : (x+w'+y'z')(x+y'+z(x'+y+z))
complement: (x'+w+yz)(x'+y+z'(x+y'+z'))

Question 4 (20 points):

a) Construct a truth table for the following function. (5 pts.)

$F(\omega, x, y, z) = \omega'z + xz + x'y + \omega x'z$

w	*x*	*y*	*z*	*w'*	*x'*	*w'z*	*xz*	*x'y*	*wx'z*	*F*
0	0	0	0	1	1	0	0	0	0	0
0	0	0	1	1	1	1	0	0	0	1
0	0	1	0	1	1	0	0	1	0	1
0	0	1	1	1	1	1	0	1	0	1
0	1	0	0	1	0	0	0	0	0	0
0	1	0	1	1	0	1	1	0	0	1
0	1	1	0	1	0	0	0	0	0	0
0	1	1	1	1	0	1	1	0	0	1
1	0	0	0	0	1	0	0	0	0	0
1	0	0	1	0	1	0	0	0	1	1
1	0	1	0	0	1	0	0	1	0	1
1	0	1	1	0	1	0	0	1	1	1
1	1	0	0	0	0	0	0	0	0	0
1	1	0	1	0	0	0	1	0	0	1
1	1	1	0	0	0	0	0	0	0	0
1	1	1	1	0	0	0	1	0	0	1

b) Use the truth table in (a) to write the function *F* in sum of minterms form. (2.5 pts.)

$F(w,x,y,z)=\sum(1,2,3,5,7,9,10,11,13,15)$

c) Represent the same function by using product of maxterms form. (2.5 pts.)

$F(w,x,y,z)=\Pi(0,4,6,8,12,14)$

d) Simplify the function in (a) using Karnaugh map. (10 pts.)

	y'z'	y'z	yz	yz'
w'x'	0	1	1	1
w'x	0	1	1	0
wx	0	1	1	0
wx'	0	1	1	1

x'y

z

F(w,x,y,z)=z+x'y

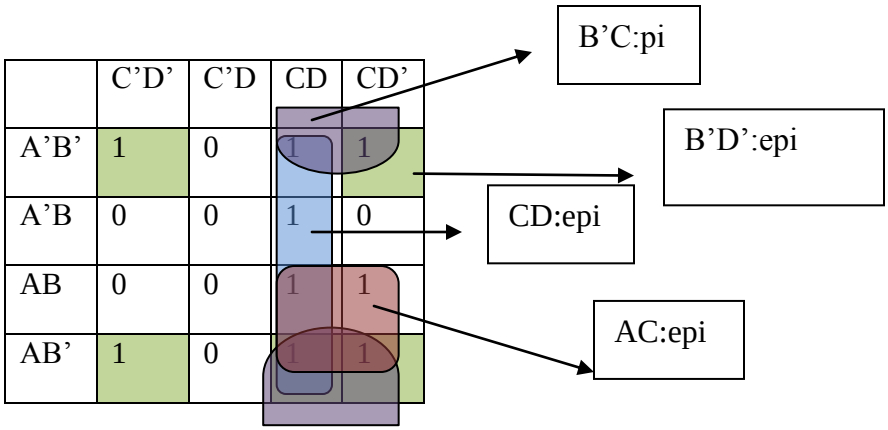
Question 5 (20 points):

Use Karnaugh Map to simplify the following Boolean function

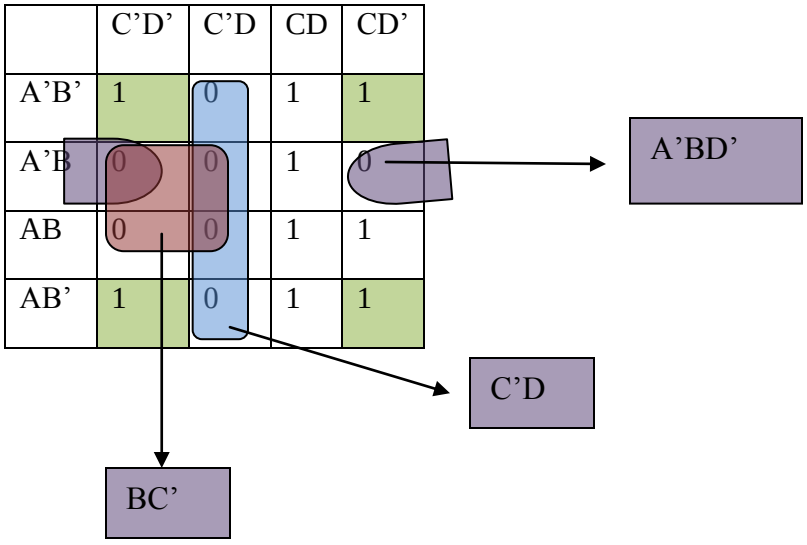
$$F(A,B,C,D) = \Sigma(0, 2,3,7, 8,10,11,14,15)$$

into

a) sum-of-products form.
b) product-of-sums form .



F(A,B,C,D) = CD+AC+B'D'



F'(A,B,C,D) = BC'+C'D+A'BD'

F(A,B,C,D)=(B'+C)(C+D')(A+B'+D)

Question 6 (20 points):

Generate the gate level implementation of the following Boolean function *F*. Use minimum number of logic gates in your implementation.

$$F(A,B,C,D) = \Pi\,(1,3,5,7,9,11,12,13,14,15)$$

	C'D'	C'D	CD	CD'
A'B'	1	0	0	1
A'B	1	0	0	1
AB	0	0	0	0
AB'	1	0	0	1

D

AB

F'=D+AB
F=D'(A'+B')