## King Fahd University of Petroleum and Minerals College of Computer Science and Engineering Computer Engineering Department

COE 202: Digital Logic Design (3-0-3) Term 092 (Spring 2010) Major Exam 1 Thursday March 25, 2010

Time: 120 minutes, Total Pages: 9

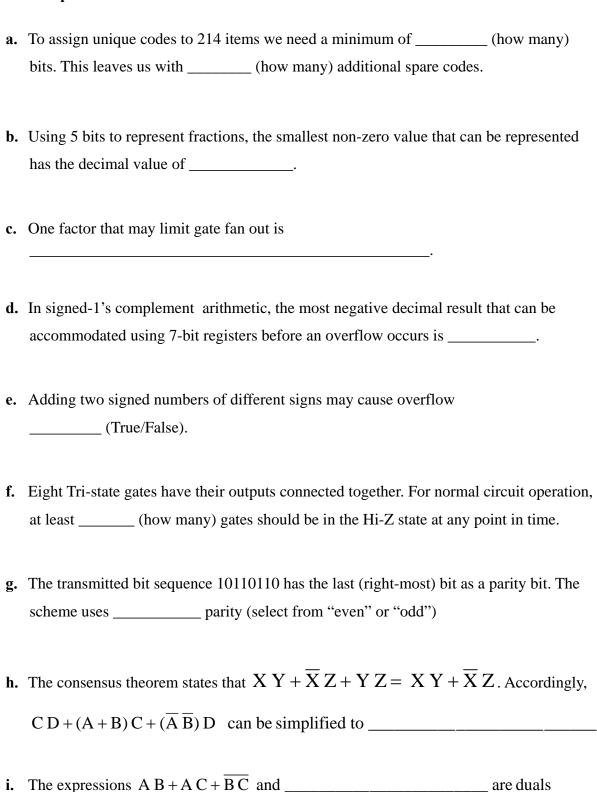
Name:_		D:	Section:
Notes:			
	Do not open the exam book until instructed		
•	Calculators are not allowed (basic advanced of	rell phones etc )	

- Answer all questionsAll steps must be shown
- Any assumptions made must be clearly stated

Question	<b>Maximum Points</b>	Your Points
1	10	
2	20	
3	38	
4	15	
5	12	
Total	95	

Question 1. (10 points)

## Fill in the Spaces:



Question 2. (20 Points)

Convert the following numbers to the specified base:

$(9D.7E)_{16} = ($	)8	$(00101001)_{BCD Code} = ($	)2
Hint: Use binary as	an intermediate step		
$(45.3)_{10} = ($	)2	$(1101011.01)_2 = ($	)10
Note: Express fraction	ons up to 3 bits only		
$(A7.4)_{16} = ($	)10	$(123)_{10} = ($	)8

Question 3. (38 Points)

a. Perform the following unsigned arithmetic operations in the specified number system. Show any corrective steps that may be required to obtain the final result. (10 Points)

Octal Subtraction	Hexadecimal	Binary	Binary Multiplication
	Addition	Subtraction	
563			1011
- 276	3DC	1010	x 1001
	+ 58E	- 0111	

b. For the binary numbers shown below, compute their equivalent decimal values if the numbers are: unsigned, in signed magnitude representation, in 1's complement representation, or in 2's complement representation. (16 Points)

Binary Number	Unsigned	Signed Magnitude Representation	1's Complement Representation	2's Complement Representation
111111				
010110				
110110				
100000				

c. If **7-bit** registers are used, show the binary representation of the following numbers in the 2's complement system: (5 Points)

	2's Complement Representation
+29	
-29	
+58	
-58	

Perform the following operations in signed 2's complement indicating cases (if any) where overflow occurred. (7 Points)

i. 
$$Z = (+29) - (+58)$$

ii. 
$$Z = (-29) - (+58)$$

iii. 
$$Z = (-29) - (-58)$$

Question 4. (15 Points)

- a. Consider the Boolean function:  $F(A, B, C) = \overline{A} \overline{B} + \overline{A} B C + A C$  (10 Points)
  - *i.* Using Algebraic manipulation, show that F can be simplified as follows:

$$F(A,B,C) = \overline{A}\overline{B} + C$$

- ii. Obtain the truth table of F
- iii. Draw a circuit of the simplified F
- **b.** Without any simplification, find the complement of the following expression and express the result in **SOP** form:

$$F(A,B,C) = (A + \overline{B} + C)(\overline{A}\overline{B} + C)(A + B\overline{C})$$
 (5 Points)

Question 5. (12 Points)

Consider the Boolean function E and F which are given by the following truth table:

X	Y	$\mathbf{Z}$	E	F
0	0	0	1	0
0	0	1	1	0
0	1	0	1	1
0	1	1	0	0
1	0	0	1	0
1	0	1	0	0
1	1	0	0	1
1	1	1	0	1

- a. Using a *numerical form* ( i.e.  $\sum m$ ,  $\Pi M$ ), list the following:
  - i. The minterms of F.
  - ii. The maxterms of F'.
  - iii. The minterms E + F.
- b. Using an algebraic form, express the following
  - i. E as a sum of minterms
  - ii. F as a product of maxterms