

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 112 (Spring 2012)
Major Exam 1
Thursday March 1, 2012

Time: 90 minutes, Total Pages: 8

Name: _____ **ID:** _____ **Section:** _____

Notes:

- Do not open the exam book until instructed
- **Calculators are not allowed** (*basic, advanced, cell phones, etc.*)
- Answer all questions
- All steps must be shown
- Any assumptions made must be clearly stated

Question	Maximum Points	Your Points
1	20	
2	12	
3	16	
4	12	
5	15	
Total	75	

Question 1.**(20 points)**

Convert the following numbers from the given base to the other uncrossed bases listed in the table (if needed, express fractions up to 3 digits only). Show your solution steps below the table.

Decimal	Binary	Octal	Hexadecimal	BCD (8421)
114.67				
	1011110.10111			
			F5A.C3	

Question 2.**(12 points)**

Perform the following arithmetic operations in the specified number system.

Octal Subtraction	Hexadecimal Addition	Binary Subtraction	Binary Multiplication
$\begin{array}{r} 2734 \\ -1776 \\ \hline \end{array}$	$\begin{array}{r} FA3B \\ +2FE9 \\ \hline \end{array}$	$\begin{array}{r} 11100010 \\ -10111111 \\ \hline \end{array}$	$\begin{array}{r} 1011 \\ \times 1011 \\ \hline \end{array}$

Question 3.

(16 points)

a. Given the function $F(A, B, C, D) = A(\overline{B} + CD) + \overline{CD}$:

i. Draw the logic implementation of the function F (use F as is, do not simplify):

ii. Compute the **complement** of the function F (use F as is, do not simplify):

b. Using Algebraic manipulation, simplify the following function to **two literals**:

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

- c. Using Algebraic manipulation, simplify the following function to **three** literals:

$$H(A, B, C, D) = AB + \bar{A}C + BD + \bar{B}\bar{C}$$

Question 4.

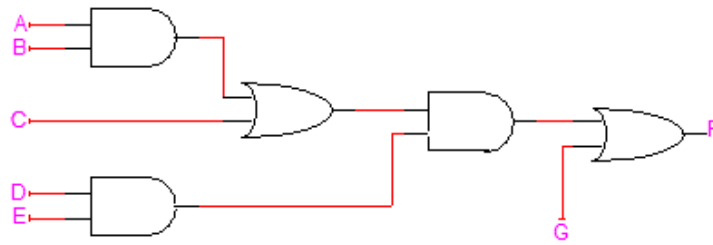
- I. Given the Boolean function $F(w, x, y, z) = (w + \bar{x}y)\bar{z}$
- Express the function as a Product of Sum (POS).
 - Express the function as a sum of minterms.
- II. Given the function $F(A, B, C, D) = \sum m(0, 3, 4, 9)$
- Give the algebraic sum of minterms expression for F .
 - Express \bar{F} as a product of Maxterms.

Question 5.

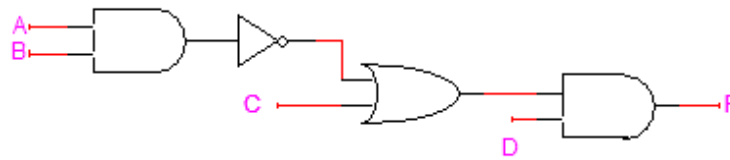
(15 points)

Fill in the Spaces: (Show all work needed to obtain your answer)

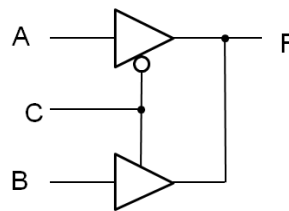
- a. In binary system, the largest value that can be expressed using n integral digits and m fractional digits is _____.
- b. Given that an 8-bit register stores the ASCII code of a character in the least significant 7 bits and a parity bit in the most significant bit. Assuming that the register contains the hexadecimal value C5 representing a character, the character stored in the register is _____ and the parity used is _____ (i.e. even or odd parity). Note that the ASCII code of character 'A' is 41h and the ASCII code of character 'a' is 61h.
- c. The number of minterms and maxterms in the function $F(A, B, C) = A + B + \bar{C}$ is _____ minterms and _____ maxterms.
- d. Given the identity $AB + \bar{A}C + BC = AB + \bar{A}C$, using the duality principle $(A + B)(\bar{A} + C)(B + C) =$ _____.
- e. Assuming that all gates have the same propagation delay of 2 ns, then the circuit takes _____ ns to produce the correct output.



f. The Boolean function implemented by the circuit given below is $F =$ _____.



g. The Boolean function implemented by the circuit given below is $F =$ _____.



h. Given an inverter with the following parameters $V_{OH}=5v$ $V_{OL}=0v$, $V_{IH}=2.8v$, $V_{IL}=2.4$, the noise margins $NM_H=$ _____ and $NM_L=$ _____.