



**King Fahd University of Petroleum and Minerals
Department of Computer Engineering**

DIGITAL LOGIC DESIGN COE 202

Exam 1, November 8, 2008

Problems	Grading
1	
2	
3	
TOTAL	

Student Name:.....

Student ID:.....

Problem-1: R's and (R-1)'s Complements and Conversions

Answer each of the following questions and show all your steps

1. Convert the following numbers from the given basis (radix)

a. $(323.25)_{10}$ to binary, octal and hexadecimal

$$(323.25)_{10} = (101000011.010)_2$$

$$(323.25)_{10} = (503.200)_8$$

$$(323.25)_{10} = (143.400)_{16}$$

b. $(10111101.101)_2$ to decimal, octal and hexadecimal

$$(10111101.101)_2 = (189.625)_{10}$$

$$(10111101.101)_2 = (275.500)_8$$

$$(10111101.101)_2 = (BD.A00)_{16}$$

2. Find the Rs and(R-1)s complements of following numbers:

a. The binary number $(1101011010100101)_2$ has its

i. Its 2's complement as:

$$(1111111111111111)_2 - (1101011010100101)_2 + 1 = (0010100101011011)_2$$

ii. Its 1's complement as:

$$(1111111111111111)_2 - (1101011010100101)_2 = (0010100101011010)_2$$

b. The octal number $(36542)_8$ has its

i. Its 8's complement as:

$$(77777)_8 - (36542)_8 + 1 = (41236)_8$$

ii. Its 7's complement as:

$$(77777)_8 - (36542)_8 = (41235)_8$$

c. The hexadecimal number $(AB5612)_{16}$ has

i. Its 16's complement as:

$$(FFFFFF)_{16} - (AB5612)_{16} + 1 = (54A9EE)_{16}$$

ii. Its 15's complement as:

$$(FFFFFF)_{16} - (AB5612)_{16} = (54A9ED)_{16}$$

Problem-2: Addition and Subtraction using R's and (R-1)'s Complements

Perform the following subtractions using the specified representation. Also indicate whether the result is positive, negative or overflow:

1. Using 7's Complement, evaluate $(3567)_8 - (4573)_8 =$

$$(3567)_8 + ((7777)_8 - (4573)_8) = (3567)_8 + (3204)_8 = (6773)_8$$

No carry, the results is correct as $(6773)_8$

2. Using 16's Complement, evaluate $(357F6)_{16} - (12345)_{16} =$

$$(357F6)_{16} + ((FFFF)_{16} - (12345)_{16} + 1) = (357F6)_{16} + (EDCBB)_{16} = (1234B1)_{16}$$

There is carry, discard the carry and the correct result is $(345C2)_{16}$

3. Using 1's Complement, evaluate $(11010011)_2 - (10101110)_2 =$

$$(11010011)_2 + ((11111111)_2 - (10101110)_2) = (11010011)_2 + (01010001)_2 =$$

$$(100100100)_2$$

There is carry, discard the carry and add 1 to least significant digit.

The correct result is $(00100101)_2$

4. Using 2's Complement, evaluate $(11010011.101)_2 - (10101110.1001)_2 =$

$$(11010011.101)_2 + ((11111111.1111)_2 - (10101110.1001)_2 + 1) = (11010011.101)_2 + (11010011.1010)_2 = (100100101.0001)_2$$

There is carry, discard the carry.

The correct result is $(00100101.0001)_2$

Problem-3: Simplification of Boolean Expressions

Note: The notation used is as follows the Complement(X) = X' and Complement(XY) = (XY)'

Simplify the following Boolean expressions. **Show all your steps:**

1. $XY + XYZ = XY.1 + XYZ = XY(1+Z) = XY$

2. $XZ + (X' + Z')Y = XZ + (XZ')Y = (XZ + (XZ)')(XZ + Y) = XZ + Y$

3. $XYZ + UV + (XYZ)'V = (XYZ + (XYZ)')(XYZ + V) + UV = XYZ+V +UV = XYZ + V.$

4. $(X + Y' + XY')' = X' . Y . (X' + Y) = X' . Y$

5. **Evaluate the dual of (X + Y' + XY')'**

First simplify expression: $(X + Y' + XY')' = (X + Y')' = X'.Y$

Evaluate the dual of the above: $X' + Y$