University of Windsor

School of Computer Science
Faculty of Science

COMP-2650: Computer Architecture I: Digital Design
Fall 2020

Date	Duration	Title	Due Date	Grade Release Date
Oct 19, 2020	180 minutes	**Midterm Exam**	Oct. 19, 2020 Midnight AoE	Nov. 11, 2020

Questions

You must show your work and all steps for every question!

Question 1: [10 marks: 2.5 marks each]
Explain the following terms in two or three sentences.

a. Continuous Quantity
b. Number System
c. Hexadecimal Number System
d. Digital System

Question 2: [10 marks: 2.5 marks each]
Assuming unsigned base-5 number system (all numbers are positive), show the maximum and the smallest unit of increment given 3 integer and 2 fraction positions in base-5 and their equal decimal values.

a. $(\text{Max?})_5 = (?)_{10}$
b. $(\text{Smallest Unit?})_5 = (?)_{10}$

Question 3: [10 marks]
Determine the radix r in this equation: $(170)_r = (2100)_4$

Question 4: [10 marks]
Show the minimum possible error when converting $(16.4)_{10}$ to base-4 if only 5 positions are given in total for both integer and fraction parts. Report the error in base-10.

Question 5: [5 marks]
Prove for any base-r, (r-1)'s-complement((r-1)'s-complement(X)) = X.

Question 6: [10 marks: 2.5 marks each]
Show the negative and positive number for decimal number 86 in base-6 using the signed-magnitude and signed-radix-complement number systems, given 5 positions for integer part with no fraction part.

a. Positive number in signed-magnitude base-6:
b. Negative number in signed-magnitude base-6:
c. Positive number in signed-radix-complement base-6:
d. Negative number in signed-radix-complement base-6:

Question 7: [10 marks: 5 marks each]
Perform the following arithmetic in singed-2's-complement base-2 for the following decimal numbers using least number of bits and check whether an overflow happens.

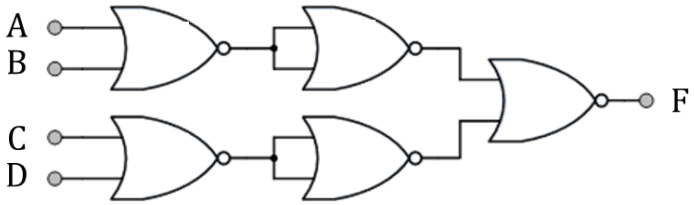
a. (+31) – (–1)
b. (+31) + (–1)

Question 8: [5 marks]
Using truth table, prove (A+B)' = A'B'

Question 9: [10 marks: 2.5 marks each]
Find all possibilities for X= $x_4x_3x_2x_1$ as a 4-bit number, when the logic operation OR applies on each bit and the result in 1111:

OR	0	1	1	0
	x_4	x_3	x_2	x_1
	1	1	1	1

Question 10: [10 marks]
Analyze the logic circuit shown below and find the Boolean expression (function) F.



Question 11: [10 marks]
Design the logic circuit for F = ∑m(1,5,6)