



**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.

- Radix Number System
- Quantization
- Octal Number System
- Binary Number System

Question 2: [10 marks: 2.5 marks each]

Assuming unsigned base-7 number system (all numbers are positive), show the maximum and the smallest unit of increment given 3 integer and 2 fraction positions in base-7 and their equal decimal values.

- $(\text{Max?})_7 = (?)_{10}$
- $(\text{Smallest Unit?})_7 = (?)_{10}$

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 's-complement(r 's-complement(X)) = X .

Question 6: [10 marks: 2.5 marks each]

Show the negative and positive number for decimal number 86 in base-9 using the signed-magnitude and signed-radix-complement number systems, given 5 positions for integer part with no fraction part.

- Positive number in signed-magnitude base-9:
- Negative number in signed-magnitude base-9:
- Positive number in signed-radix-complement base-9:
- Negative number in signed-radix-complement base-9:

Question 7: [10 marks: 5 marks each]

Perform the following arithmetic in signed-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 $(AB)' = A' + B'$

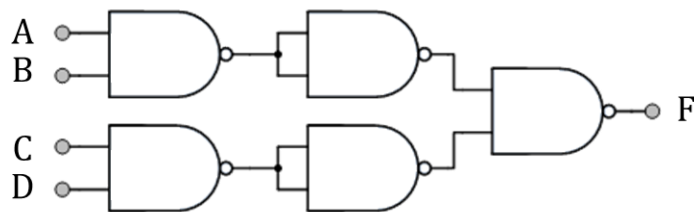
Question 9: [10 marks: 2.5 marks each]

Find all possibilities for $X = x_4x_3x_2x_1$ as a 4-bit number, when the logic operation AND applies on each bit and the result is 0000:

AND	0	1	1	0
	x_4	x_3	x_2	x_1
	0	0	0	0

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 $F = \sum m(1,2,7)$.