ENCS2340 l Section 2 l Fall 2024/2025
Chapter 1
Extra Exercises

1. Workout the missing values in the table below. Utilize binary to obtain all Octal and Hexadecimal representations. **Round** all obtained fractions to 3 places only (show all calculations performed)

Decimal	Binary	Octal	Hexadecimal
99.1875			
	1001011.1101		
		174.564	
			2BC.7D

2. a. Represent the decimal value 75.8 in:
   (If fraction conversion does not terminate, **round** the fraction to 4 places in the target number system. Note: Get the Hexadecimal value by iterative division/multiplication by 16)
   i. BCD ii. Binary iii. Hexadecimal (from the binary representation)

   b. Considering the number (including the decimal point) as four characters, represent each character as a 7-bit ASCII binary codes + an additional odd parity bit appended as the MSB (i.e. to the left of the ASCII code). Express the number as a sequence of 8 hexadecimal digits.

3. A store has 5639 different items in stock.
   i. How many bits are required to give each item a unique binary code?

   ii. What is the maximum number of additional items can the above coding system accommodate?

   iii. It is anticipated that number of stock items will double every two years over the next four years (i.e. it will double twice). How many bits will be needed four years from now?

4. A computer register consists of 21 bits. For this register, determine each of the following:
   a. Largest number of:
   - Binary codes that can be provided
   - Full BCD digits that can be accommodated in the register
   - Full 7-bit ASCII codes that can be accommodated in the resister

   b. The most negative signed integer that can be represented in the signed 2's complement notation (give value in decimal)

   c. Smallest (non-zero) and Largest unsigned fractions that can be represented (express results rounded to the form x.xxxxxx 10^{-y})

5. Let a = 1010, b = 0110, c = 0011 be 3 unsigned binary numbers. Perform each of the following unsigned operations. Show all carries/borrows. **Extend bits to accommodate the result if needed**. Verify that you get the correct decimal answer.
   i. a + b ii. a - b iii. ab + c iv. ab - c

6. In each of the following, determine the radix r that makes the statement correct:

i. 16 x 3 = 54 ii. (44)/3=13 iii. 14 x 23 = 410

7. Interpret the binary bit sequence 10010110 as: (Give all corresponding numeric values in decimal)

a. A 7-bit ASCII code with an additional parity bit appended at the LHS of the ASCII
b. An unsigned integer
c. A Signed 1's complement integer
d. A Signed 2's complement integer
e. A Signed-magnitude integer
f. An unsigned decimal number in BCD
g. A signed decimal number in BCD

8.
a. Represent the decimal number -56 in 7 bits using each of the following notations:
i. Signed-magnitude, ii. Signed 1's Complement iii. Signed 2's Complement

b. For each of the 3 notations above, use sign extension rules to represent the same number in 12 bits

9. Do the following **unsigned** number subtractions through the addition of the 2's complement of the subtrahend, without rearranging the two numbers before the operation. Detect and correct a wrong result. Verify your results in decimal.

a. 10100 – 01101 b. 01100 – 10110

10. Assuming the given numbers are represented in the signed-2's complement notation, perform the following operations. Check for overflow. Verify your results in decimal.

a. 101110 – 001110 b. 100101 - 110110 c. 111011 + 001110 d. 101101 + 110001

11. Perform the following arithmetic operations in 2's complement representation using 6 bits: Use the numbers as given in brackets. Check for overflow. Verify results in decimal.

a. (+29) + (-16) b. (-17) - (+13)

12. Perform the following signed subtraction operation: (+141) + (-263) using:

a. Decimal arithmetic
b. Signed 10's complement arithmetic in decimal
c. Signed 10's complement arithmetic in BCD.
(Represent numbers as signed BCD and perform digit operations in binary using the "add 6" method to handle decimal carry)

Verify that you get the same result in all three cases.