

# Introduction to Computing

## CPIT 201 - Homework 2 - Due **September 19**

- 1) Store **22** in an 8-bit memory location using unsigned representation? Show your work?

Change the number from Decimal to Binary	$(22)_{10} \text{ -----} \rightarrow (10110)_2$
Add three bits to the left to make it 8 bits	0 0 0 1 0 1 1 0

- 2) Store **-31** in an 8-bit memory location using sign-and-magnitude representation? Show your work?

Change the number from Decimal to Binary	$(-31)_{10} \text{ -----} \rightarrow (11111)_2$
Store -31 in 7 bits	0 0 1 1 1 1 1
Add the sign	<b>1</b> 0 0 1 1 1 1 1

- 3) Store **-36** in an 8-bit memory location using two's complement representation? Show your work?

Change the number from Decimal to Binary	$(-36)_{10} \text{ -----} \rightarrow (100100)_2$
Store -36 in 8 bits	0 0 1 0 0 1 0 0
Apply two's complement operation	$  \begin{array}{ccccccc}  0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 \\  \downarrow & \downarrow & \downarrow & \downarrow & \downarrow & & & \\  \hline  1 & 1 & 0 & 1 & 1 & 1 & 0 & 0  \end{array}  $

- 4) Retrieve the integer that stored as 11100111 in memory in unsigned format? Show your work?

Convert the number from Binary to Decimal	$  \begin{aligned}  (11100111)_2 &= (1 \times 2^7) + (1 \times 2^6) + (1 \times 2^5) + \\  &+ (0 \times 2^4) + (0 \times 2^3) + (1 \times 2^2) + (1 \times 2^1) + (1 \times 2^0) = (231)_{10}  \end{aligned}  $
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- 5) Retrieve the integer that stored as 11100111 in memory in sign-and-magnitude format? Show your work?

The leftmost bit is 1 so the number in Decimal is negative.	<b>1</b> 1 1 0 0 1 1 1 1
Convert the number from Binary to Decimal without the leftmost number.	$  \begin{aligned}  (11001111)_2 &= (1 \times 2^7) + (1 \times 2^6) + (0 \times 2^5) + \\  &+ (0 \times 2^4) + (1 \times 2^3) + (1 \times 2^2) + (1 \times 2^1) + (1 \times 2^0) = (207)_{10}  \end{aligned}  $

Add the negative sign	$(-207)_{10}$
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6) Retrieve the integer that stored as 11010101 in memory in two's complement format? Show your work?

The leftmost bit is 1 so the number in Decimal is negative.	<b>1</b> 1 0 1 0 1 0 1
Apply two's complement operation	$  \begin{array}{ccccccc}  1 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\  \downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \\  0 & 0 & 1 & 0 & 1 & 0 & 1 & 1  \end{array}  $
Convert the number from Binary to Decimal	$  \begin{aligned}  (00101011)_2 &= (0 \times 2^7) + (0 \times 2^6) + (1 \times 2^5) + \\  &\quad (0 \times 2^4) + (1 \times 2^3) + (0 \times 2^2) + (1 \times 2^1) + \\  &\quad (1 \times 2^0) = (43)_{10}  \end{aligned}  $
Add the negative sign	$(-43)_{10}$

7) Using floating-point representation (IEEE\_127) (single precision), show the process how **(-36.36)** is represented?

The number is negative.	S=1		
Convert the number from Decimal to Binary	$(100100.0101)_2$		
Normalization $(100100.0101)_2$	$(1.001000101)_2 \times 2^5$		
S	E	M	
1	$5+127=132$ 10000100	001000101000000000000000	

8) The bit pattern (010001110 00000000010110101010000)<sub>2</sub> is stored in IEEE\_127 format. Show the value in decimal? Show your work?

S	E	M
0	$10001110$ $142-127=15$	00000000010110101010000
$(1.00000000010110101010000)_2 \times 2^{15}$		
Convert the number from Binary to Decimal	$(1000000000101101.01010000)_2 =$ $(32813.80)_{10}$	

- 9) Use the **last digit** of your student number (6) as **6-bit** memory location in **two's complement**

a) How many different patterns (symbols) can be represented using **6** bits?

$$6^2=36$$

b) show the range for all numbers that can be represented (minimum and maximum values)?

$$\text{Maximum} = (2^{6-1}) - 1 = 31$$

$$\text{Minimum} = - (2^{6-1}) = -32$$

c) Show the binary representation of the **first two numbers** and the **last two numbers**?

$(31)_{10} = (011111)_2$	$(30)_{10} = (011110)_2$
$(-32)_{10}$ is negative, take the two's complement and then stores it.	$1\ 0\ 0\ 0\ 0\ 0$ $1\ 0\ 0\ 0\ 0\ 0$
$(-31)_{10}$ is negative, take the two's complement and then stores it.	$0\ 1\ 1\ 1\ 0\ 0$ <div style="text-align: center;"> <math>\downarrow\ \downarrow\ \downarrow</math> </div> $1\ 0\ 0\ 1\ 0\ 0$

d) Discuss when an overflow would happen?

Occurs when adding two positive numbers produces a negative result, or when adding two negative numbers produces a positive result. Adding operands of unlike signs never produces an overflow. For example:

$$01010000 = 80$$

$$+ 01010000 = 80$$

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$$10100000 = -96 \text{ (not 160 because the sign bit is 1.)}$$