EXAM 1
CIS 310
Winter, 2021
Your Name _____Demetrius Johnson_____ 2/20/2021

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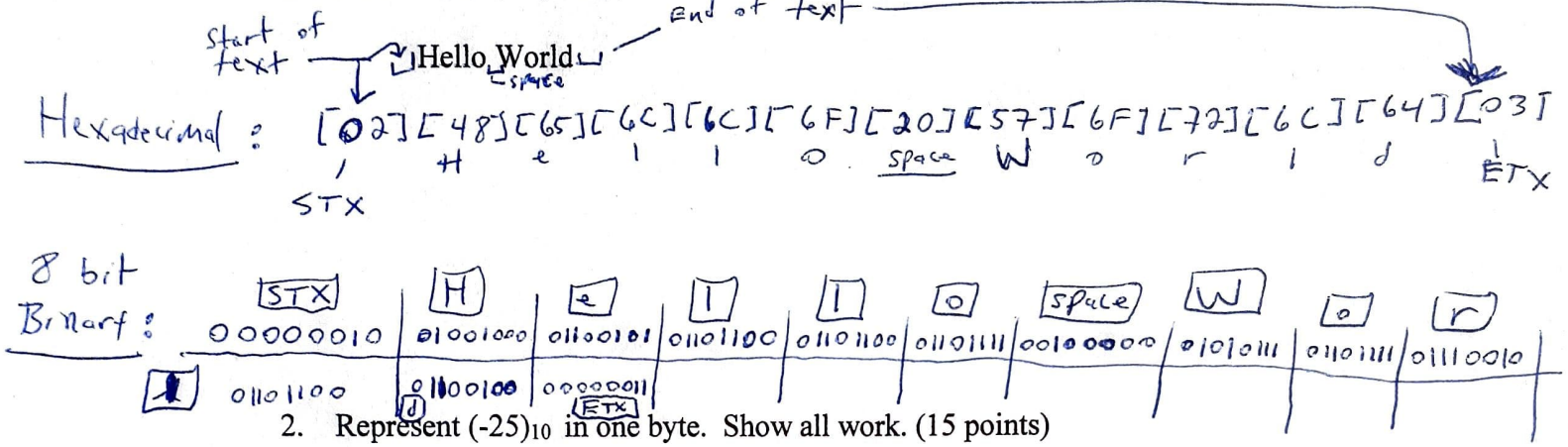
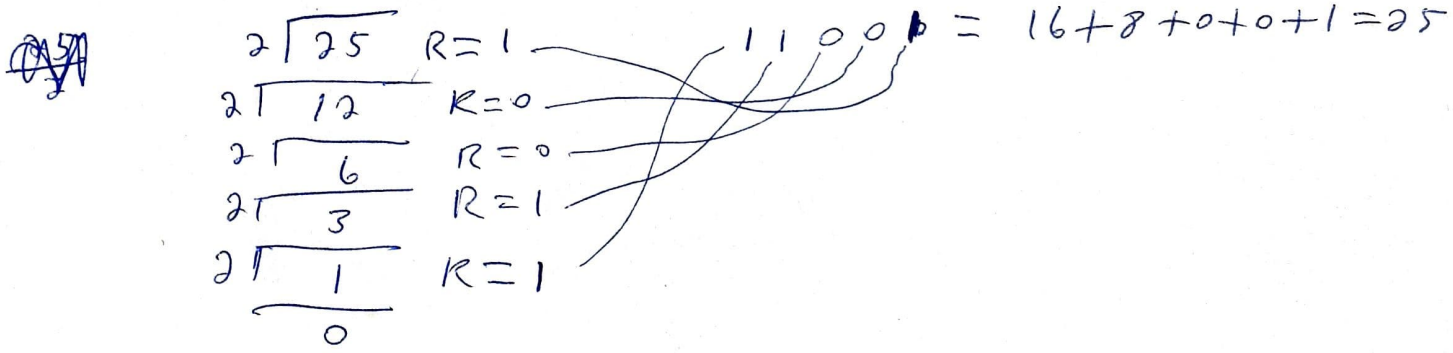
1. Encode (or translate) the following string in ASCII. Use the ASCII table at the end of the exam. (10 points)



2. Represent $(-25)_{10}$ in one byte. Show all work. (15 points)

① First find binary value of 25



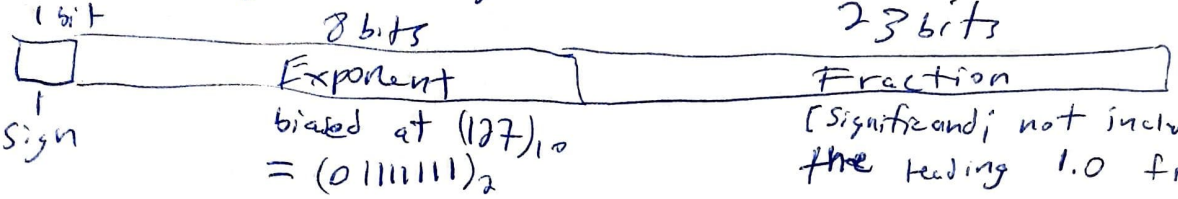
So $(25)_{10}$ = 11001 in binary

② Now since $(25)_{10}$ is signed → $(-25)_{10}$, take 2's complement; switch all bits, add 1.

original → 11001
switch bits → 00110
Add 1 → 00111 → Thus $(-25)_{10}$ = 00111 in binary

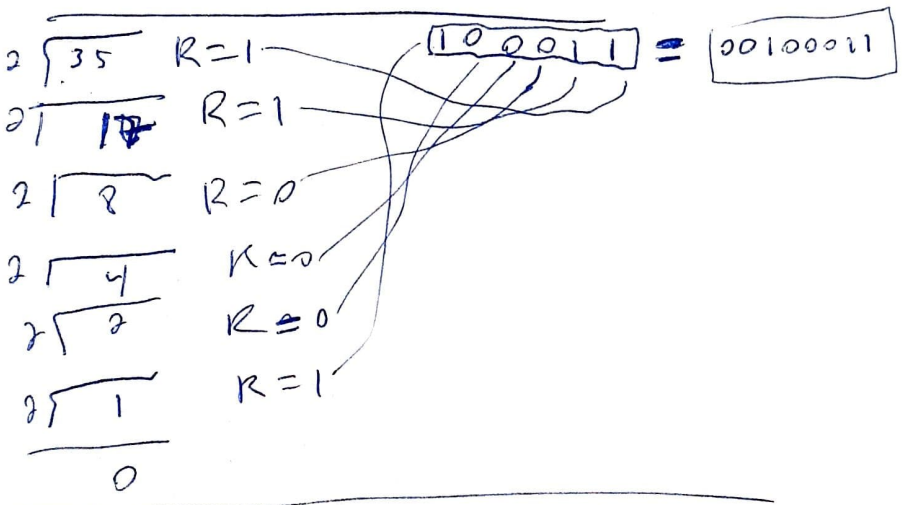
3. Represent $(-35.125)_{10}$ in IEEE Floating Point Format. Show all work. (25 points)

Sign = negative; sign bit set to on = 1.



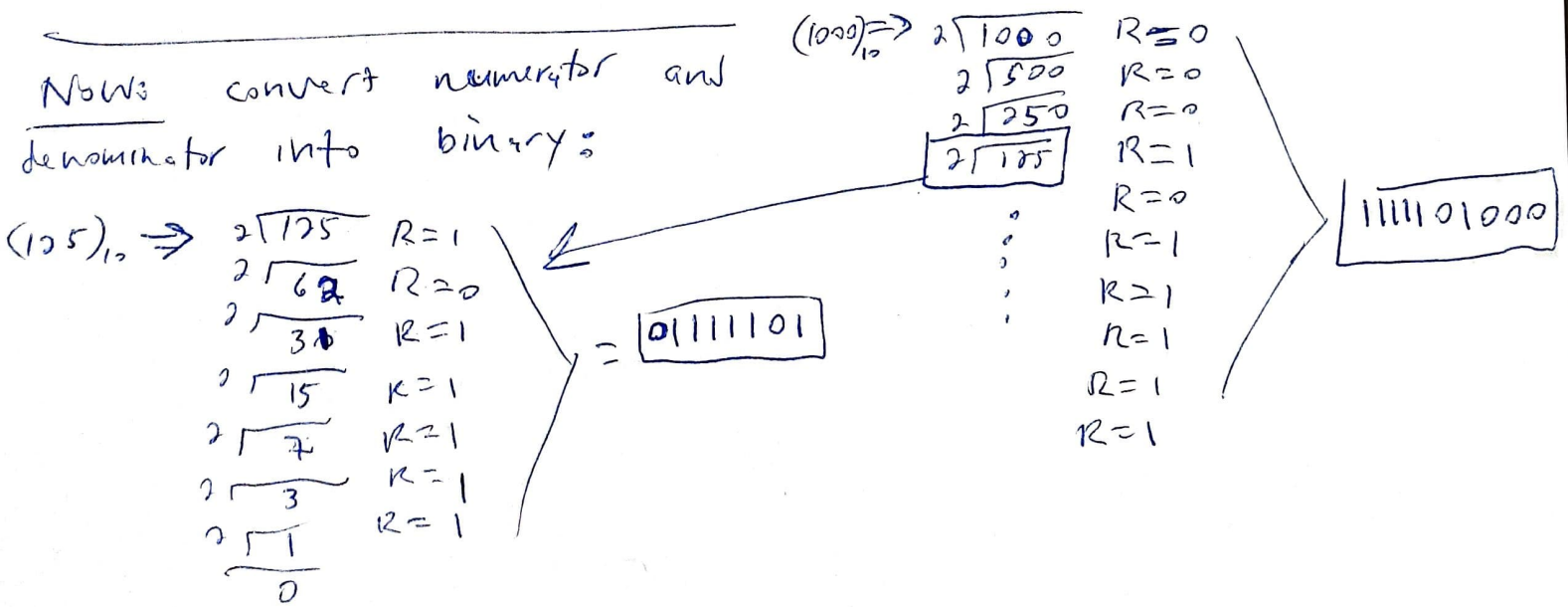
Sign = 1 = negative

35 → convert to binary:



Now, convert 0.125 into a proper fraction: $\frac{125}{1000}$

Now: convert numerator and denominator into binary:



So Now we have: sign bit → negative → 1

$(35)_{10} = 00100011$

$(0.125)_{10} = \left(\frac{125}{1000}\right)_{10} \Rightarrow \left(\frac{0001111101}{1111101000}\right)_2$

Now, convert $\left(\frac{0001111101}{1111101000}\right)_2$ to binary decimal:

Divide:

$$\begin{array}{r} 0.000000000.001 \\ 1111101000 \overline{)\,0001111101.000} \end{array}$$

Thus we have done it: $\left(\frac{0001111101}{1111101000}\right)_2 = (0.001)_2$

At this point, we now know:

sign bit = negative = 1

$(35)_{10} = (00100011)_2$

$(0.125)_{10} = (0.001)_2$

$\Rightarrow (35.125)_{10} = (100011.001)_2$

Now for IEEE, we have to normalize the binary value:

$100011.001 \longrightarrow 1.00011001$; moved decimal over by 5 place values; thus our base 2 exponent is (+5)

(5 places)

Thus $1.00011001 \cdot 2^5$; No Need to indicate 1.0 in the floating point format.

(1.00011001 = Significand; 2^5 = Exponent = +5)

Since IEEE has exponent ISsued 8 bits, biased at $(127)_{10} = (01111111)_2$

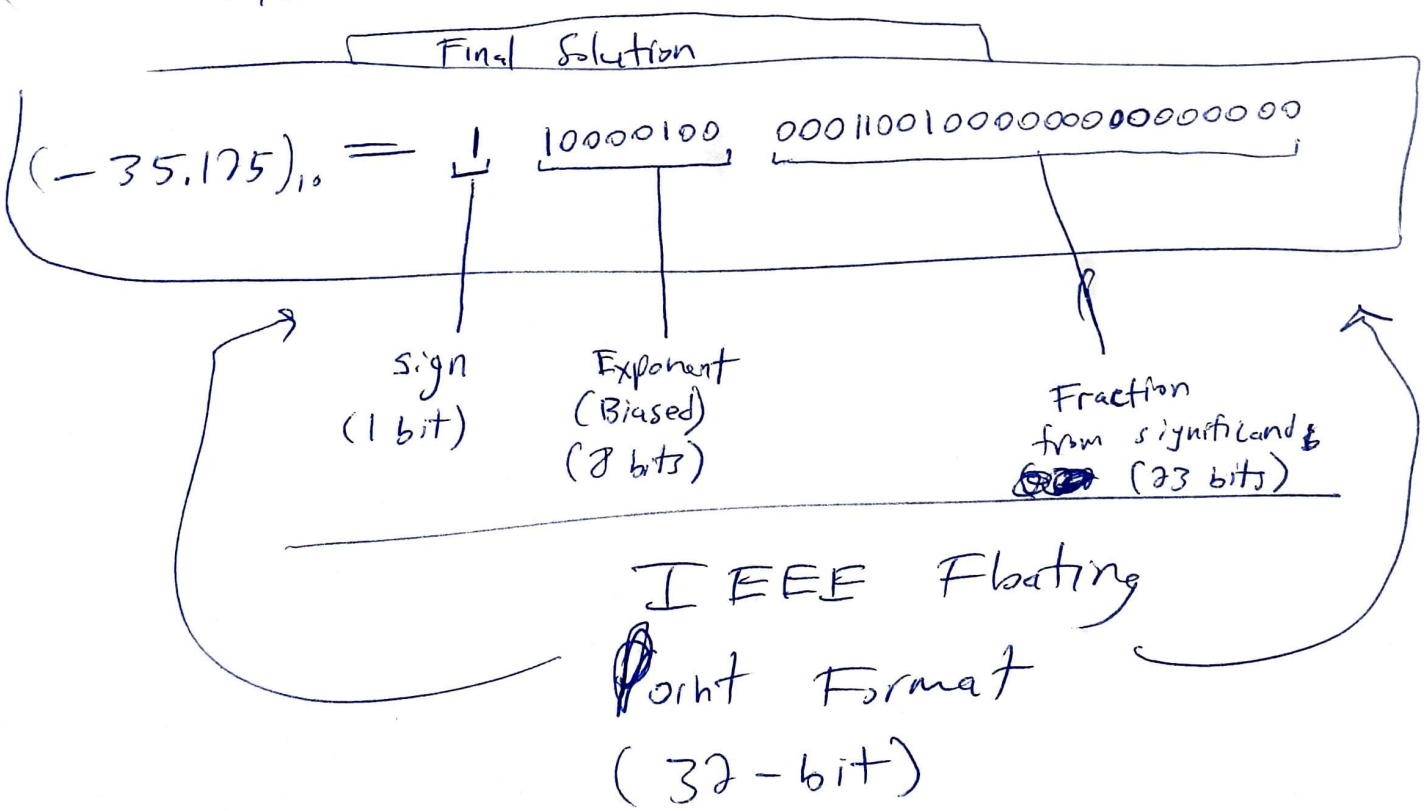
Then we add: 5 + 127 = 132. Convert this to a 8-bit binary value:

$(132)_{10} \Rightarrow$ binary

$$
\begin{array}{r|l}
2 & 132 \quad R=0 \\
2 & 66 \quad R=0 \\
2 & 33 \quad R=1 \\
2 & 16 \quad R=0 \\
2 & 8 \quad R=0 \\
2 & 4 \quad R=0 \\
2 & 2 \quad R=0 \\
2 & 1 \quad R=1 \\
\hline
 & 0
\end{array}
$$

$$10000100 = (132)_{10}$$

Thus we now know the solution to $(-35.125)_{10}$ in IEEE Floating Point Format:



4. The following represents a floating point number in IEEE floating point format. Figure out how much it represents in decimal. Show all work (25 points)

42C88000 → Assuming this is hexadecimal?

01000010 11000100 00000000 00000000

→ $(42C88000)_{16}$ → binary form

every 4 bits is a hex digit; thus:

4 = 0100, 2 = 0010, C = $(12)_{10}$ = 1100, 8 = 0100 (2 of these), 0 = 0000 (3 of these)

Thus 42C88000 ⟹ 0 | 10000101 | 10001000100000000000000

8 × 4 = 32 bits

0 → sign

10000101 → biased (by 127) exponent

10001000100000000000000 → fraction part of significand

- Since sign bit = 0, the number is positive.
- Convert biased exponent to unbiased to solve for proper exponent:

$(10000101)_2$ → biased ⟹ $128 + 4 + 1 = (133)_{10}$; To convert to unbiased, subtract 127; 133 − 127 = +6

Thus, base 2 Exponent = +6.

Now, use fraction part to get significand; add 1.0 + fraction

⟹ 1.0 + 0.10001000 1 = 1.10001000 1

Now, multiply significand by the base 2 exponent of +6 to denormalize the binary value: $1.10001000\,1 \times (2^6)_{10} = 1100010.001$

Now, convert the non-fractional part of the binary value into decimal:

(7-bits)

$(1100010)_2 \Rightarrow 1\times2^6 + 1\times2^5 + 1\times2^1 = 64+32+2 = (98)$

so $(1100010)_2 = (98)_{10}$

- Now, Convert fraction part to decimal:

$(0.001)_2 \Rightarrow$ Decimal : $\Rightarrow 0\times2^{-1} + 0\times2^{-2} + 1\times2^{-3} = \frac{1}{2^3} = \left(\frac{1}{8}\right)_{10}$

Now Convert $\left(\frac{1}{8}\right)_{10}$ to ~~Decimal~~ Fraction

$$
\begin{array}{r|l}
 & 0.125 \\
\hline
8 & 1.0 \\
 & -8 \\
\hline
 & 20 \\
 & -16 \\
\hline
 & 40
\end{array}
$$

Thus Now we have the solution

sign bit = Positive

Decimal whole = 98

Fractional Decimal = 0.125

(IEEE FPR)

$(42C88000)_{16} = \boxed{98.125}$

Final Answer

(8 bits)

5. Draw the memory map of the following data: (put one byte in each cell). (25 points)

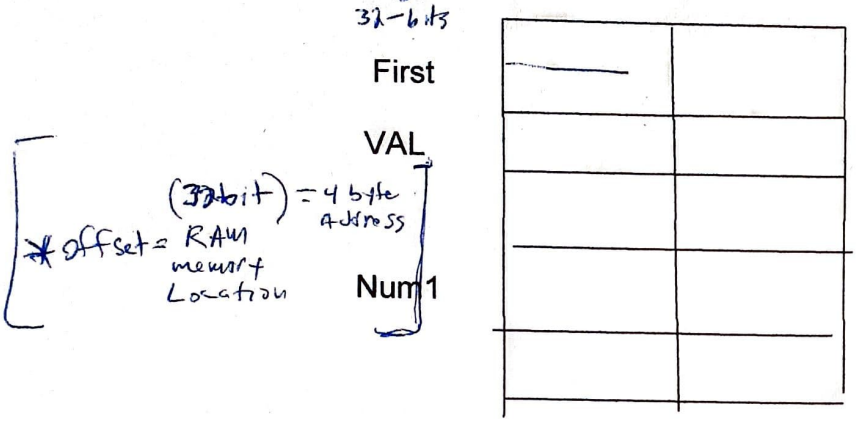
```
.DATA
First     BYTE     20, 13
VAL       DWORD    34217825h
Num1      REAL4    -35.125
```

80 bits (10 bytes) total allocated

→ we calculated this in a previous problem to be: 1 10000100 00011001000000000000000

In Hex = C20C8000

*Remember: every 2 Hex digits can be stored in 1 byte.



*offset = RAM memory Location

(32bit) = 4 byte address

*Multi-byte integers are stored in memory in reverse order, with LSByte stored at lowest address: (Little Endian)

Variable	1 BYTE	Offset
(BYTE) First (Array)	$(20)_{10}$	0000
	$(13)_{10}$	0001
(DWORD) VAL	$(25)_{16}$	0002
	$(78)_{16}$	0003
	$(21)_{16}$	0004
	$(34)_{16}$	0005
(REAL4) Num1	$(00)_{16}$	0006
	$(80)_{16}$	0007
	$(0C)_{16}$	0008
	$(C2)_{16}$	0009