Problem 1 (9 points)

Convert the number in each row to each other notation, filling in all the cells of the table. If the number cannot be represented in a particular notation, write N/A in that box. Use 8 bits for all binary numbers.

<table>
<thead>
<tr>
<th>Decimal</th>
<th>Unsigned Binary</th>
<th>Signed Binary</th>
<th>Two’s Complement</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>10001101</td>
<td></td>
<td>10110011</td>
</tr>
</tbody>
</table>

Problem 2 (4 points)

a) Consider a coffee company was looking to design a system to keep track of coffee orders. They want to give each type of coffee they sell a different binary number. If they have twenty types of coffee, how many bits do they need to make sure each type has a unique binary number? Assume unsigned notation.

b) If the coffee company wanted to expand the types of coffee they offer, how many new coffee types can they add without increasing the number of bits they are currently using?

Problem 3 (6 points)

Perform the following binary arithmetic and logical operations. Assume two’s complement notation.

a) \[ \begin{array}{c}
11001011 \\
+10011000 \\
\end{array} \]

b) \[ \begin{array}{c}
11001011 \\
-10011000 \\
\end{array} \]

c) \( (11001011 \ \text{AND} \ 11110001) \ \text{OR} \ (\text{NOT} \ 11101010) \)
Problem 4 (4 points)

Convert 7.25 in to fixed point notation (use unsigned notation, any amount of bits you need) and in to 32 bit floating point notation.

Problem 5 (1 bonus point)

How would you perform multiplication using only addition, subtraction, AND, OR, or NOT? Any amount of any operation can be used, and not all of them have to be used.