CSE 20 Discussion

Week 2

Questions courtesy to CSE 20 WI 20
1. Fill in the blanks of the definition of the recursive function $\textit{ones}$, which takes a bitstring as input and gives the number of 1s in the bitstring as output. Note that the set of all bitstrings is denoted as $\{0, 1\}^*$. 

\begin{align*}
\text{Basis Step:} \\
\text{Recursive Step:}
\end{align*}
2. Base Conversion Practice

(a) Please fill out the following table below for fixed width representations:

<table>
<thead>
<tr>
<th>base 10 (width 2)</th>
<th>base 16 (width 1)</th>
<th>base 2 (width 4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(10)_{10,2}</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(11)_{10,2}</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(12)_{10,2}</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(13)_{10,2}</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(14)_{10,2}</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(15)_{10,2}</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(b) Find the base 2 expansions of the following:
   i. $(1337)_8$
   ii. $(A96B1)_{16}$

(c) Find the base 8 expansion of $(11010101110)_2$

(d) Find the base 16 expansion of $(101011100011001110)_2$

(e) Find the base 2, fixed-width binary expansion of 0.1 with integer part width 1 and fractional part width 8.
3. When we have two positive integers $n$ and $m$, dividing $n$ by $m$ means writing $n$ as $mq + r$ where $q$ is the (integer) quotient and $r$ is the (integer) remainder, with $0 \leq r < m$. We can also write $q$ as $n \text{ div } m$ and $r$ as $n \text{ mod } m$.

(a) Compute $11 \text{ div } 3$ and $11 \text{ mod } 3$

(b) Compute $-7 \text{ div } 4$ and $-7 \text{ mod } 4$
4. For each of the numbers below, write the number in:

- binary expansion
- binary fixed-width 4
- sign-magnitude width 4
- 2’s complement width 4

or determine that it is not possible.

(a) 5
(b) -7
(c) -8
Consider the logic circuit

For which of the following settings(s) of input values is the output $y_1 = 0$? (Select all and only those that apply.)

i. $x_1 = 0$, $x_2 = 0$, $x_3 = 0$, and $x_4 = 0$

ii. $x_1 = 1$, $x_2 = 1$, $x_3 = 1$, and $x_4 = 1$

iii. $x_1 = 1$, $x_2 = 0$, $x_3 = 0$, and $x_4 = 1$

iv. $x_1 = 0$, $x_2 = 0$, $x_3 = 1$, and $x_4 = 1$
Consider the logic circuit

For which of the following settings(s) of input values is the output $y_1 = 1$ and $y_2 = 1$? (Select all and only those that apply.)

i. $x_1 = 0$, $x_2 = 0$, $x_3 = 0$, and $x_4 = 0$
ii. $x_1 = 1$, $x_2 = 0$, $x_3 = 1$, and $x_4 = 1$
iii. $x_1 = 1$, $x_2 = 1$, $x_3 = 0$, and $x_4 = 0$
iv. $x_1 = 0$, $x_2 = 0$, $x_3 = 1$, and $x_4 = 1$