IEEE 754 Standard Floating Point Representation

1) Convert the value 23.625\textsubscript{10} to its binary representation.

\[
\begin{array}{cccccc}
64 & 32 & 16 & 8 & 4 & 2 & 1 & .5 & .25 & .125 & .0625 \\
\end{array}
\]

2) Normalize the above value so that the most significant 1 is immediately to the left of the radix point. Include the corresponding exponent value to indicate the motion of the radix point.

\[
1. x 2 \quad 101010
\]

3) Write the corresponding 32-bit IEEE 754 floating point representation for 23.625\textsubscript{10}.
4) Write the corresponding 64-bit IEEE 754 floating point representation for $23.625_{10}$.

5) What would be the smallest positive normalized 32-bit IEEE 754 floating point value?

6) The smallest positive denormalized 32-bit IEEE 754 floating point value has representation of

<table>
<thead>
<tr>
<th>8-bit</th>
<th>23-bit Mantissa</th>
</tr>
</thead>
<tbody>
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<td>Sign bit</td>
<td>Exponent (bias 127)</td>
</tr>
<tr>
<td>0 ( \equiv ) +</td>
<td>0 0 0 0 0 0 0 0 0 0 0 0 ...</td>
</tr>
<tr>
<td>1 ( \equiv ) -</td>
<td>0 0 0 0 0 0 0 0 0 0 0 0 ...</td>
</tr>
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What value would it represent?

\[
2 \square \times 2 ^ {\square}
\]

7) What would be the representation for the largest positive denormalized 32-bit IEEE 754 floating point?

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Lecture 4 Page 2
8) How would you add two IEEE 754 floating point numbers?

9) How would you multiply two IEEE 754 floating point numbers?

10) Consider adding $1.011 \times 2^{40}$ and $1.01 \times 2^5$.
   a) How many places does the second number's mantissa get shifted?

   b) After we add these two numbers and store the results back into a 32-bit IEEE 754 value, what would be the result?