Software Homework #9 (3.5 points)
Due to Gradescope by 11:45 PM on Tuesday, February 25th
You need to submit a pdf to Gradescope; failure to mark which pages your questions are on will result in a 10% deduction on your grade

Homework Goal: Work with assembly language and machine language

1. Rank the following programming languages from the lowest level (left) to the highest level (right): Python, Machine language, Assembly language (0.5 points)


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3. Suppose \( a, b, c, \) and \( d \) are in memory locations \( M[100], M[101], M[110], \) and \( M[111] \), respectively. Write an algebraic equation that represents the following assembly language instructions: (1 point)

\[
\begin{align*}
\text{ADD } & M[100] \text{ } M[100] \text{ } M[100] \\
\text{ADD } & M[100] \text{ } M[100] \text{ } M[100] \\
\text{ADD } & M[111] \text{ } M[111] \text{ } M[111] \\
\text{ADD } & M[110] \text{ } M[100] \text{ } M[111] \\
\text{ADD } & M[110] \text{ } M[110] \text{ } M[101]
\end{align*}
\]

4. Assume the variables \( v, w, x, y, \) and \( z \) are stored in memory locations \( M[001], M[010], M[011], M[100], \) and \( M[101] \), respectively. Using the machine language instructions shown in Section 4.2, fill in the blanks to translate the following algorithmic operations into their machine language equivalents. You can overwrite a memory location for an intermediate calculation, if that location is no longer needed. See Zybooks activities 4.2.2 and 4.2.3 for examples. (1 point)

a. Set \( v \) to the value of \( (w + x) + (y + z) \)

\[
\begin{array}{cccccccc}
1 & 1 & 0 & 1 & 0 & & & & \\
1 & 1 & 1 & 0 & 0 & & & & \\
1 & 1 & & & & 0 & 1 & 0 & 1 & 0 & 0 \\
\end{array}
\]

b. Input \( v \) from the user, then display \( v \times 2 \)

\[
\begin{array}{cccccccc}
& & & & & 0 & 0 & 0 & 0 & 0 & 0 \\
1 & 1 & & & & & & & & & \\
& & & & & 0 & 0 & 1 & & & \\
\end{array}
\]