Hints for Machine Assignment #5

Consider the desired list \([X_1, X_2, \ldots X_n]\). It has to satisfy two constraints:

The first is:
\[
X_1 + X_2 + X_3 + \ldots + X_n = 2^N
\]
expressing that the total number of occurrences of numbers in the list representing
the X’s is both \(X_1 + X_2 + X_3 + \ldots + X_n\) and \(2^N\)

The second is:
\[
0 \times X_1 + 1 \times X_2 + \ldots + (N-1) \times X_n = N \times (N+1)/2,
\]
expressing that the sum of numbers which appear in the list of X’s is both
\(1 \times X_1 + 2 \times X_2 + \ldots + N \times X_n\) and \((X_1 + \ldots + X_n) + (1 + \ldots + N)\)

Notice that \(N\) is known, i.e., the length of the list of X’s. Therefore the two above
constraints are linear and can be handled by CLP(R). Furthermore, the solution
offered by CLP(R) has to satisfy the condition that all the X’s have to be integers
(within a certain accuracy –check the specs for CLP(R)).

Further hint:

Keep two lists \(L_X\) and \(L_Y\) where \(L_X = [X_1, X_2, \ldots X_n]\) and \(L_Y\) is initially a list
containing \(N\) ones, i.e., \(L_Y = [1, 1, \ldots 1]\); write a short program that keeps adding
one to an element of \(L_Y\) whenever it finds an X in the list \(L_X\). You may use \textit{append’s}
for that purpose.

Some results of the program, where \(X\) is the desired list

\[
\begin{align*}
{X} &= \langle 3, 1, 3, 1 \rangle, \\
{X} &= \langle 2, 3, 2, 1 \rangle, \\
{X} &= \langle 3, 2, 3, 1, 1 \rangle, \\
{X} &= \langle 4, 3, 2, 2, 1, 1 \rangle,
\end{align*}
\]

Good Luck!