1) Solve the following linear program using SIMPLEX:

\[
\begin{align*}
\text{maximize} & \quad 18x_1 + 12.5x_2 \\
\text{subject to} & \quad x_1 + x_2 \leq 20 \\
& \quad x_1 \leq 12 \\
& \quad x_2 \leq 16 \\
& \quad x_1, x_2 \geq 0.
\end{align*}
\]

2) Solve the following linear program using SIMPLEX:

\[
\begin{align*}
\text{maximize} & \quad 5x_1 - 3x_2 \\
\text{subject to} & \quad x_1 - x_2 \leq 1 \\
& \quad 2x_1 + x_2 \leq 2 \\
& \quad x_1, x_2 \geq 0.
\end{align*}
\]

3) Show that if a DECREMENT operation were included in the \( k \)-bit counter example, \( n \) operations could cost as much as \( \Theta(nk) \) time.

4) Suppose we perform a sequence of \( n \) operations on a data structure in which the \( i \)th operation costs \( i \) if \( i \) is an exact power of 2, and 1 otherwise. Use aggregate analysis to determine the amortized cost per operation.

5) You go up to the elevator and press the button. But who knows how long it's going to take to come, if ever? How long should you wait until you give up and take the stairs?
Say it takes time \( E \) to get to your floor by elevator (once it comes) and it takes time \( S \) by stairs. Eg., maybe \( E = 15 \) sec, \( S = 45 \) sec.
What strategy has the best competitive ratio?