Name:

PID:

1. Design a Turing machine that computes the function \( n \rightarrow n \div 1 = \max\{0, n - 1\} \) where \( n \in \Sigma^* \) and \( n + 1 \in \Sigma^* \) are binary representations of integers. Describe it with a state diagram (preferred) or a transition function \( \delta \). This is called “truncated subtraction”.

2. Describe (at a high level) how a Turing machine can double the symbols in its input, \( a_1a_2a_3\ldots a_n \mapsto a_1a_1a_2a_2a_3a_3\ldots a_na_n \).

3. Describe (at a high level) how a Turing machine can compute the inverse of the symbol-doubling function.