1. 4 points

(i) Put a box around the correct choice concerning (1):
M, N, M and N, neither M nor N has state-determined output.

(ii) Give the state machine (2) of the composition.

2. 6 points For each statement below, determine if it is true or false and put a box around your answer.

(1) There is no 2-state machine with \( Inputs = Outputs = \{0, 1\} \) that recognizes the pattern 111. \( \text{T} \)

(2) If the constant input \( x = (0, 0, 0, \cdots) \) is input to a machine with \( n \) states, the output will eventually be periodic i.e. of the form:
\[
y = (y_0, \cdots, y_p, y_{p+1}, \cdots, y_{p+k}, y_{p+1}, \cdots, y_{p+k}, \cdots)
\]
\( \text{T} \)

(3) If a deterministic machine \( B \) simulates machine \( A \) with the simulation relation \( S_{AB} \subset States_A \times States_B \), then \( A \) simulates \( B \) with the simulation relation
\[
S_{BA} = \{(s_B, s_A) \mid (s_A, s_B) \in S_{AB}\}
\]
\( \text{T} \)

(4) Suppose machine \( B_1 \) simulates \( A_1 \) and \( B_2 \) simulates \( A_2 \). Then the cascade composition of \( B_2 \) and \( B_1 \) simulates the cascade composition of \( A_2 \) and \( A_1 \). \( \text{T} \)