Turing Machine exercises

1. Design a Turing Machine to accept the language \( \{a^2b^n \mid n \geq 0\} \), with \( \Sigma = \{a, b\} \). (This is problem 1.4.5a from the textbook.)

2. Design a Turing Machine to accept the language \( \{(ab)^n \mid n \geq 0\} \), with \( \Sigma = \{a, b\} \). (This is problem 1.4.5n from the textbook.)

3. Design a Turing Machine to compute \( f(n) = 2n + 3 \). (This is problem 1.5.3a from the textbook.)

4. Design a Turing Machine to compute \( f(n) = C_4^1(x) \).

5. Design a Turing Machine to compute \( f(n) = p_2^3(x, y) \).

The input and output for #3-5 will be written in unary-plus-one notation; that is, \( n \) will be represented as a string of \( n+1 \) 1s.