Solution to Problem 9

**Problem.** Design a Turing machine that computes a function \( f(n) \) which is equal:

- to \( n + 3 \) when \( n > 0 \) and
- to 0 when \( n = 0 \).

Assume that the input \( n \) is given in unary code.

**Solution.** If after moving 1 step to the right, we see blank, we go back and halt. Otherwise, we go right until we see blank. Then, we replace 3 blanks with 1s, go back, and halt.

- start, \(-\) → R, moving
- moving, \(-\) → L, halt
- moving, 1 → R
- moving, \(-\) → 1, R, added1st1
- added1st1, \(-\) → 1, R, added2nd1
- added2nd1, \(-\) → 1, L, back
- back, 1 → L
- back, \(-\) → halt