The Theory of Computation
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Solution Manual
Chapter 4, Problem 5.5

This is again similar to the increment and decrement routines. We use the register transfer routine of Exercise 4.4 and the addition routine of Exercise 4.2, part (3). The catch here is in organizing the pieces of the operation. First, it is easiest to use the strategy of Exercise 4.2, part (3), and construct the result to the left of the entire input string; we can then think of it as a register, use the routine of Exercise 4.4 to transfer it to its rightful destination, and come back to erase it and leave the head at the beginning of the tape; not only does this approach simplify the addition, it also automatically handles properly the case where the target register is the same as one of the operands. Secondly, we need to handle the case of the addition calling for the tow operands to be the same—in the same register; again, we can provide a general solution by copying the second argument to the left of the input, thinking of it as a register; then the sum is computed to the left of *that* register; after transferring the sum to the correct register, we then erase both the sum and the copy of the second operand. Thus all we need is register transfer and addition; both take time proportional to the square of the space used.