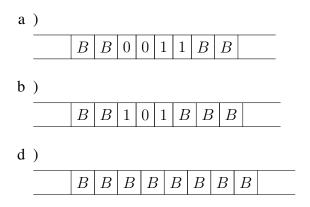
# **13.5 Turing Machines**

# 13.5 pg. 897 # 1

Let T be the Turing machine defined by the five-tuples:  $(s_0, 0, s_1, 1, R)$ ,  $(s_0, 1, s_1, 0, R)$ ,  $(s_0, B, s_1, 0, R)$ ,  $(s_1, 0, s_2, 1, L)$ ,  $(s_1, 1, s_1, 0, R)$ , and  $(s_1, B, s_2, 0, L)$ . For each of these initial tapes, determine the final tape when T halts, assuming that T begins in initial position.



## 13.5 pg. 898 # 3

What does the Turing machine described by the five-tuples  $(s_0, 0, s_0, 0, R)$ ,  $(s_0, 1, s_1, 0, R)$ ,  $(s_0, B, s_2, B, R)$ ,  $(s_1, 0, s_1, 0, R)$ ,  $(s_1, 1, s_0, 1, R)$ , and  $(s_1, B, s_2, B, R)$  do when given

- a) 11 as input?
- b) an arbitrary bit string as input?

## 13.5 pg. 898 # 7

Construct a Turing machine with tape symbols 0, 1, and B that, when given a bit string as input, replaces the first 0 with a 1 and does not change any of the other symbols on the tape.

#### 13.5 pg. 898 # 9

Construct a Turing machine with tape symbols 0, 1, and B that, when given a bit string as input, replaces all but the leftmost 1 on the tape with 0s and does not change any of the other symbols on the tape.

#### 13.5 pg. 898 # 11

Construct a Turing machine that recognizes the set of all bit strings that end with a 0.

## 13.5 pg. 898 # 13

Construct a Turing machine that recognizes the set of all bit strings that contain an even number of 1s.

## 13.5 pg. 898 # 19

Construct a Turing machine that computes the function f(n) = n - 3 if  $n \ge 3$  and f(n) = 0 for n = 0, 1, 2 for all nonnegative integers n.