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.

a )

\begin{array}{cccccc}
B & B & 0 & 0 & 1 & 1 B B \\
\end{array}

b )

\begin{array}{cccccc}
B & B & 1 & 0 & 1 & B B B \\
\end{array}

d )

\begin{array}{cccccc}
B & B & B & B & B & B \\
\end{array}

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 \( n \geq 3 \) and \( f(n) = 0 \) for \( n = 0, 1, 2 \) for all nonnegative integers \( n \).