The Theory of Computation

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Solution Manual

Chapter 4, Problem 5.18

Intuitively, we shall use one stack to simulate the portion of the tape to the left of the head and the other stack for the portion of the head to the right of the head, with the character under the head arbitrarily assigned to one stack. Moving the head of the Turing machine then corresponds to popping an item off one stack and pushing it (or some other value, as changed by the Turing machine's transition) onto the other stack. As in Exercise 4.17, we can think of the finite automaton first copying its input into one stack, then from that point on using only ε-transitions on the input and dealing exclusively with the two stacks. Moving past a blank one either end of the Turing machine tape corresponds to increasing storage in one stack (which contains everything) and having a single item in the other stack. We leave small details unspecified, but it is clear that our 2-stack machine can simulate a Turing machine and is therefore universal.