Regular Languages and Finite Automata

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Notes to the instructor

Notes on Task 2:

The usual logic for addition requires the carry bit to be passed sequentially from the lower ordered digits to the higher ordered digits as the addition process is performed. Recall that, with Kleene's model, the logic for determining the *i*-th bit (an inner cell) at time *t* is said to be "determined by the states of all the cells [that include the input cells and inner cells] at time t - 1". However, Kleene's model leaves it wide open how the states of all the cells at time t - 1 decide the state of an inner cell at time *t*. So, the mechanism for determining the state of an inner cell can indeed be summarized by a sequential procedure (as employed in the addition logic).

Notes on Task 8:

In [1] and [3], both textbooks use the state elimination method in constructing a regular expression from a given finite automaton. The construction requires the introduction of the concept of generalized nondeterministic finite automata. In [2], a dynamic programming approach, that resembles Floyd-Warshall's algorithm for computing transitive closure of a graph, is used. On the other hand, Kleene's approach seems to be more in line with the usual mathematical induction technique in that the assertion is proved for a small number of states, and an induction step is used to prove the claim as the number of states increases. So, it is quite possible that the students may find Kleene's approach more "natural-looking" assuming that they have had a good training in writing mathematical induction proofs.

References

- [1] J. E. Hopcroft, R. Motwani and J. D. Ullman, Introduction to automata theory, languages, and computation, 2nd Edition, Addison-Wesley, 2001.
- [2] J. E. Hopcroft and J. D. Ullman, Introduction to automata theory, languages, and computation, Addison-Wesley, 1979.
- [3] M. Sipser, Introduction to the theory of computation, 2nd Edition, Thomson Course Technology, 2006.

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