Tutorial 08

UNIVERSITY OF VICTORIA

CSC 320 - SPRING 2023

FOUNDATIONS OF COMPUTER SCIENCE

Teaching Team

Learning Outcomes:

- Construct high level Turing Machines.

- Prove that a language is decidable by construction.

Interesting Article:

"Non-Erasing Turing Machines: A New Frontier Between A Decidable Halting Problem and
Universality" [1]
"Strongly Universal Quantum Turing Machines and Invariance of Kolmogorov Complexity" [2]

March 14th, 2023

Question 8.01

Prove that the following language is decidable by constructing (high level) Turing Machines which decide the language.

$$A_{DFA} = \{\langle B, w \rangle \mid B \text{ is a DFA that accepts input string } w\}$$

Question 8.02

Prove that the following language is decidable by constructing (high level) Turing Machines which decide the language.

$$E_{DFA} = \{\langle A \rangle \mid A \text{ is a DFA and } L(A) = \emptyset\}$$

Question 8.03

Prove that the following language is decidable by constructing (high level) Turing Machines which decide the language.

$$EQ_{DFA} = \{\langle A, B\rangle \mid A \text{ and } B \text{ are DFAs and } L(A) = L(B)\}$$

Bibliography

[1]   M. Margenstern, "Non-erasing turing machines: A new frontier between a decidable halting problem and universality," English, in *LATIN '95: Theoretical Informatics*, G. Goos, J. Hartmanis, J. van Leeuwen, R. Baeza-Yates, E. Goles, and P. V. Poblete, Eds., vol. 911, Berlin, Heidelberg: Springer Berlin Heidelberg, 1995, pp. 386–397, ISBN: 978-3-540-59175-7. DOI: 10.1007/3-540-59175-3_104. [Online]. Available: http://link.springer.com/10.1007/3-540-59175-3_104.

[2]   M. Muller, "Strongly universal quantum turing machines and invariance of kolmogorov complexity," English, *IEEE Transactions on Information Theory*, vol. 54, no. 2, pp. 763–780, 2008, ISSN: 0018-9448. DOI: 10.1109/TIT.2007.913263. [Online]. Available: http://ieeexplore.ieee.org/document/4439860/.