

Problem Set 7 – Due Friday, May 15, 2015

For this problem set you may work in teams of 1–3 people. Submit one solution per team as described below.

Problem 1. Design a Turing machine that decides the $<$ function (as a binary predicate on numbers represented in binary). Specifically, your machine should accept strings of the form $x < y$ where $x, y \in (0, 1)(0, 1)^*$ and the number represented by x is less than that represented by y . Your machine should reject all other strings. As a few examples, your machine will accept $100 < 101$ and $0100 < 101$ and $0 < 10$ but reject $11 < 11$ and $011 < 11$ and $0 < 00$, as well as $1 < 10$ and $1 <$ and ε .

Rather than following the conventions of your book, please use those of the website <http://morphett.info/turing/turing.html>. In particular, you'll be using a two-way infinite tape. Rather than using designated accept and reject states to indicate your machine's decision, have your machine accept by halting with a 1 written under its head, and have your machine reject by halting with a 0 written under its head.

Try to make your program use *as few rules as possible*, measured by the number of 5-tuples that you need. Test your machine on plenty of inputs. A prize will go to the smallest machine that passes the TA's correctness tests.

Submit your solution, one per group, in the (newly added) "Assignment" section on SmartSite. Your solution should be an ASCII file (`tm.txt`) that you upload. The TA will test it using the TM simulator above. A comment at the top of your program must list the *names* of the team members, in alphabetical order by last name; and the *number of rules* you used. Only submit one assignment per group. The student who should submit the assignment is the one with the alphabetically-first last name.