

Department of Computer Science, University of Houston

COSC 3340 - Exercise Set 1

Fall 08, Due Fri. Sept 24 (online) at 5pm

Submit one pdf file on Blackboard containing everything screenshots, images, text, etc.

1. (a) Give the formal-level specification of a DTM for deciding the language $\{a^m b c^n \mid m \neq n\}$. Save this in file hw4prob1a.
(b) Run your first design of TM on JFLAP with at least 3 strings in the language and at least 3 strings not in the language. List the test strings and the verdicts of JFLAP with your solutions.
2. Design machine schemas of deterministic TMs for:
 - (i) deciding the language $\{I^n \mid n \text{ is divisible by } 5\}$. The TM should start at the 1st blank cell to the right of the input. Assume that there is an empty cell at the left-end and then the input.
 - (ii) given a number x in unary notation, outputs the number 2^x in unary notation. The output should be separated from the input by a blank cell and the TM should start at the 1st blank cell to the right of x . Assume that there is an empty cell at the left-end and then the input x .
3. A clique in an undirected graph $G = (V, E)$ is a subset of the vertices, say V' , such that every pair of vertices in V' has an edge between them. The size of a clique V' is $|V'|$, the number of vertices in V' . Give the algorithmic description of a nondeterministic Turing machine for accepting the following language: $\{ \langle G, k \rangle \mid G \text{ is an undirected graph containing a clique of size at least } k \}$. Indicate clearly in your answer the steps in which guessing is involved and exactly what is guessed in each such step.
4. Is reducibility: (i) a reflexive relation? (ii) a symmetric relation? State this mathematically and prove or disprove for each case.
5. Show that the class of Turing-acceptable languages is closed under concatenation and kleene star operations.
6. For any two languages A and B , if $A \leq B$ (i.e., there is a reduction from A to B) and B is a regular language, does that imply that A is a regular language? Why or Why not? Justify in detail.
7. Let $S = \{ \langle M \rangle \mid M \text{ is a TM that accepts } w^R \text{ whenever it accepts } w \}$. Show that S is undecidable.