ComSS 331 Fall 2017 Name:_____

HW 10 Due 3 nov 2017

1. Prove that the class of Turing-acceptable languages is closed under union, intersection, and reversal. For each property, give a detailed sketch of the proof, by saying how you would build a Turing machine that accepts the resulting language, given the Turing machine(s) that accept the original language(s). 50

2. Prove or disprove that the set of Turing-acceptable languages is closed under concatenation. 15

3. Consider a new type of *deterministic* machine, having one read-only input tape and two stacks. The tape is read-only, it cannot be written, but the head can move left, right, or do nothing. Each stack operates, independently of the other, as in a deterministic pushdown automaton:

$$M = (K, \Sigma, \Gamma_1, \Gamma_2, z_1, z_2, \delta, s)$$

where K is a finite set of states, Σ is a finite input alphabet, Γ_1 and Γ_2 are two finite stack alphabets (Γ_1 for the first stack, Γ_2 for the second stack), $z_1 \in \Gamma_1$ and $z_2 \in \Gamma_2$ are the initial symbols for the two stacks, $s \in K$ is the initial state. h is a special halting state not in K, just like in a Turing machine.

   (a) Give an appropriate definition for the transition function δ, for a configuration of this machine, for the "yields in one step" operator, and for the language accepted by this machine.

   (b) These machines can accept the same languages as a class of automata you already know: deterministic pushdown automata, pushdown automata, or Turing machines? Prove your answer formally.

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