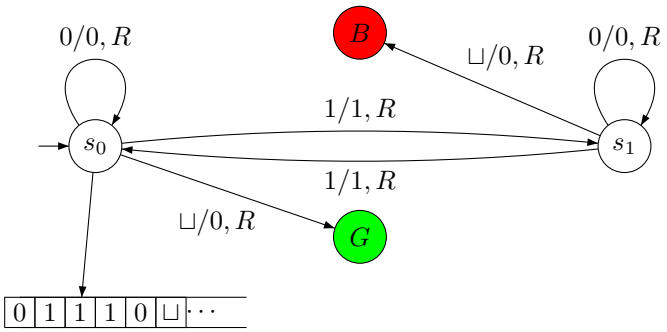
Pop Quiz (35 min)

June 5, 2013

1. Consider the foll Turing machine over input alphabet $\{0, 1\}$: (10 marks):



   (a) Give a full formal description of the TM (hint: 7-tuple).
   (b) What is the current configuration of the TM?
   (c) Describe the run (sequence of configurations) of the TM on (i) the empty string, (ii) 100011
   (d) What is the language accepted by the TM?
   (e) Is this language regular? Is it decidable?

2. Consider the language $L = \{ww^R \mid w \in \{0, 1\}^*\}$ (10 marks)
   (a) Is L regular? Prove by constructing an NFA or disprove using pumping lemma.
   (b) Is L recursively enumerable? If yes, give a high-level description of a Turing machine accepting it and sketch the actual TM.
   (c) Is L decidable?

3. State the Church-Turing thesis (in your own words!). Can you give a formal proof for it? (6 marks)

4. Arrange the following classes of languages by set inclusion: (i) recursively enumerable languages (ii) languages accepted by non-deterministic finite-state machines (iii) decidable languages (iv) regular languages [-note: specify both strict and non-strict inclusion] (4 marks)