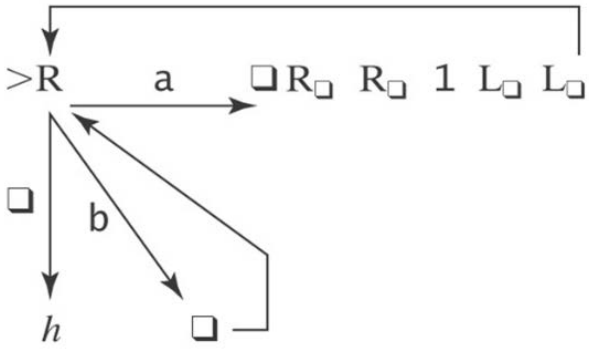
MA/CSSE 474 Day 29 Summary

1) A macro language for TMs. On a separate handout. You need to learn to read and write this language. Suggestion: Write notes about the macro language on your handout.
2) Exercise: What does this machine do?



3) Exercise: Initial input on the tape is an integer written in binary, most significant bit first (110 represents 6).

   Design a TM that replaces the binary representation of *n* by the binary representation of *n*+1.

4) **TMs as language recognizers**. Let $M = (K, \Sigma, \Gamma, \delta, s, \{y, n\})$.
   a) *M* ***accepts*** a string *w* iff $(s, \underline{\Box}w) \vdash_M^* (y, w')$ for some string *w*′.
   b) *M* ***rejects*** a string *w* iff $(s, \underline{\Box}w) \vdash_M^* (n, w')$ for some string *w*′.
   c) *M* ***decides*** a language $L \subseteq \Sigma^*$ iff for any string $w \in \Sigma^*$ it is true that:
      i) if $w \in L$ then *M* accepts *w*, and
      ii) if $w \notin L$ then *M* rejects *w*.
   d) A language *L* is ***decidable*** iff there is a Turing machine *M* that decides it.
   e) We define the set ***D*** to be the set of all decidable languages.
   f) *M* ***semidecides*** *L* iff, for any string $w \in \Sigma_M^*$:
      i) $w \in L \rightarrow M$ accepts *w*
      ii) $w \notin L \rightarrow M$ does not accept *w*. *M* may either reject or fail to halt.
   g) A language *L* is ***semidecidable*** iff there is a Turing machine that semidecides it.
   h) We define the set ***SD*** to be the set of all semidecidable languages.