C240 Computability and Complexity
Tutorial 4

1. Design a Turing Machine M with input alphabet {a, b}, which, given as input a word w of this alphabet, outputs the word obtained from w by writing out it's a's, and then its b's, in order.For example:

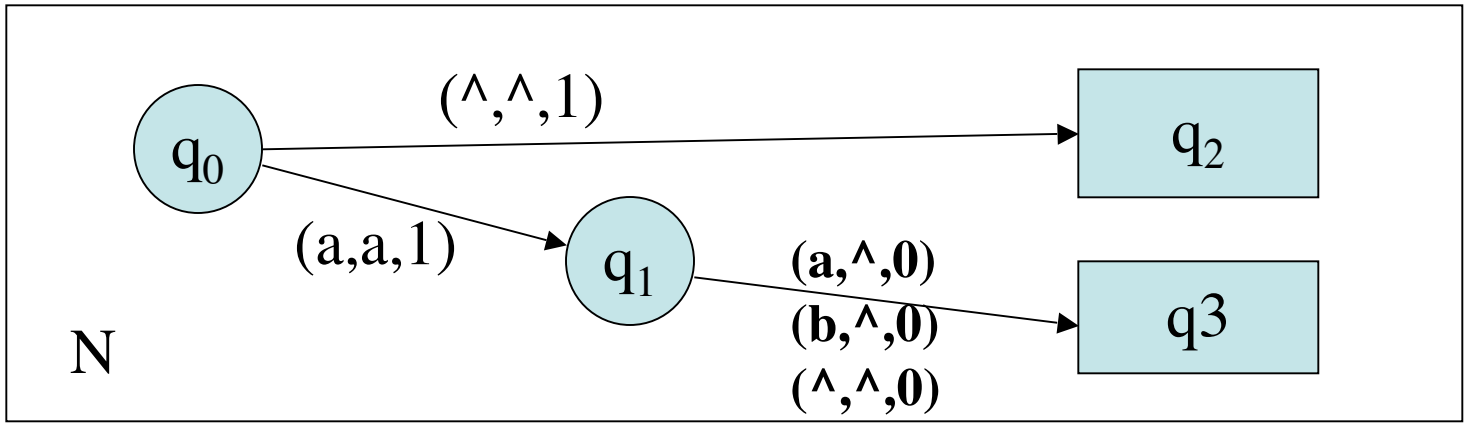
   f_M(ababaa) = aaabb

   You may use pseudo-code or a flow-chart (state) diagram; in the latter case you should explain your notation for instructions.

   You may use several tapes, and you can assume that square 0 of each tape is implicitly marked.

2. (a) What is meant by the term "standard Turing machine"

   (b) What does the following standard Turing machine N do?
   (ie. What is its input/output function?)



3. The Universal Turing machine U can be made a standard Turing machine. So can M and N above. (assume M Halts & Fails if its input word is not in {a, b}. So they have codes, namely code(U), code(M), code(N). Calculate

   f_U(Code(U)*code(M)*babba)

   f_U(code(U)*code(N)*)

   $f_U$code(U)*code(U)*code(N)*c)