The universal Turing machine

Idea: specific TM U that takes in a TM M as input, along with input I to that TM M, and do whatever M does on I.

(i.e. & U is a TM-interpreter)

In order for this to make sense, we need some standard for
1) How to specify M (for U)
2) How to specify I.

E.g. one possibility:

(I need to specify transitions, start state, final state)

- Note - an arbitrary TM has an arbitrary alphabet. I can't allow this for U since U must have a single
How can we construct $U$?

We'll construct a 3-head 3-tape machine:

Tape 1: Always just has (the encoding of) $M$.

Tape 2: The tape contents of $M$ at the current point of the computation. (encoded as 1's + #')

Tape 3: The current state of $M$ (encoded as some number of 1's)

(Maybe we need a tape
(Maybe the current head position of tape 2 also has a special mark.)

We have to make $U$ simulate $M$ so we should think about the "loop" on $U$ that simulates a single transition in $M$. 
2) Update tape 2 and tape 3
   a) copy the new state to tape 3
      (and blank the rest of it)
   b) copy the new symbol to tape 2
      (moving the stuff do the right
      either to make room or to delete
      blank room as necessary)
   c) move the marker for current
      spot on tape 2 as necessary.

This is the loop for 1 step.