Supplemental Questions on: Decidability and Recursive Languages

F1: Consider a version of a TM where, if it changes a character, the head must move right. Show that this version has the same power as a standard TM.

F2: (a) Show that recursive languages are closed under first halfs. That is, if L is recursive then so is the language consisting of the first half of every even-length string in L.
(b) Show that r.e. languages are closed under first halfs.

F3: A ***wombat*** is a deterministic model of computation. A wombat is like a TM in that it has finite memory and an infinite tape with a single head, on which the head can move both ways. However, the tape is read-only. Show that the acceptance problem for wombats is decidable.

F4: Given an NFA M, one can create a new NFA M^s by interchanging the accept and reject states. (That is, changing every accept state to a reject state and every reject state to an accept state.) Define an NFA M as ***happy*** if M and M^s accept the same language. Show that it is decidable to determine if an NFA is happy.

F5: Show that it is decidable to determine, given an NFA, whether there exists a string that the NFA accepts along two different paths.

F6: A 2FA is like a deterministic FA except that it has two heads and these heads can move in both directions on the read-only tape (but not off the tape). Show that the Halting Problem for a 2FA is decidable.

F7: Show that the language $\{ \langle G \rangle : G \textit{ is a CFG that accepts at least 100 strings} \}$ is recursive.