

Q1.

Most students get good marks from this question. Few marks are deducted for missing details as long as I can understand what you built.

Main reasons for losing marks:

Several students define a TM to determine the odd/even of the binary number instead of counting number of “1”s.

Someone define Turing machines that does something else such as checking if there are two or more “1”s in the string, etc.

Q2.

The question is not answered well.

Many students were trying to reduce  $L_H$  to  $L_U$ , which in the wrong direction. They build a Turing machine with another Turing machine recognizing  $L_U$  in it, not the other way around, and then claimed that since this building is not valid,  $L_H$  is not recursive.

By  $L_H$  not recursive we mean it's impossible to build a TM  $M$  such that  $L(M) = L_H$ . Not that you just try to build a TM machine and failed.

Q3.

The question is answered fine.

Common problems are:

1. In defining the Turing machine, some students suggested the nondeterministic Turing machine to guess an arbitrary string and didn't state how to mimic infinite number of possible Turing machines.
2. A few students try to reduce  $L_{ne}$  to  $L_n$  which does not make sense to me.
3. For the correct proving without stating “universal Turing machine” will be deducted 1 pt
4. Some students defined multi-tape deterministic Turing machines but didn't clearly stated how to simulate infinite number of TM's.