1.

$$
\begin{aligned}
S &\rightarrow QE \\
Q &\rightarrow 0QZ \mid 1QN \mid F \\
FN &\rightarrow FR1 \\
FZ &\rightarrow FR0 \\
F &\rightarrow \epsilon \\
R0N &\rightarrow NR0 \\
R0Z &\rightarrow ZR0 \\
R0E &\rightarrow 0 \\
R1N &\rightarrow NR1 \\
R1Z &\rightarrow ZR1 \\
R1E &\rightarrow 1 \\
R11 &\rightarrow 11 \\
R10 &\rightarrow 10 \\
R01 &\rightarrow 01 \\
R00 &\rightarrow 00
\end{aligned}
$$

basically it generates $ww^{\text{Я}}$ which a normal grammer can do and then reverses $w^{\text{Я}}$ with the power of an unrestricted grammar to form ww.

2.

the assignment didn't ask for proofs so I'm hoping that these intuitions are enough of a answer.

a)

This language as acceptable because M will use a finite number of cells when it halts or when it gets caught in a loop over the same section of tape which can be detected by tracking the machines configurations. In both of these cases we can accept $\rho(M)\rho(w)$, however for use to be able to decided that it will not use a finite number of cells we would have to be able to decide that M will not halt on w and if we could do that we could solve the halting problem.

b)

This can be decided because if M halts using n or less cells we can accept $\rho(M)\rho(w)01^n0$, and if we track the configurations of M and detected that a configuration is repeated after using less than n cells we know that it will continue to loop over those n cells, allowing us to accept $\rho(M)\rho(w)$ even if M doesn't halt. If however M ever goes past n cells we can halt and reject. Allowing us to decided L