1. Let \( L \) be the language of all palindromes (strings \( w \) such that \( w = w^R \)) over \( \{0,1\} \) containing an equal number of 0s and 1s. Prove that \( L \) is not context-free.

2. Apply the Cocke-Kasami-Younger algorithm to the following Chomsky Normal Form grammar to show that the string \textit{babbaa} is accepted (please show the tableau):

\[
\begin{align*}
S & \rightarrow AB|BA|AT|BU|SS \\
T & \rightarrow SB|SU \\
U & \rightarrow SA \\
A & \rightarrow a \\
B & \rightarrow b
\end{align*}
\]

3. Consider the following Turing machine with accept state \( q_a \):

We have not drawn the reject state, \( q_r \), or transitions going to the reject state. Those transitions occur implicitly whenever a state lacks an outgoing transition for a particular symbol. In each of the parts below, give the sequence of configurations that this machine enters when started on the indicated input string (a configuration is both a state and the contents of the tape).

(a) \text{1#1}  
(b) \text{10#11}
4. **Extra Credit:** To be done for the glory, not the points. Show that the problem of determining whether a CFG generates all strings in \( L(1^*) \) is decidable. In other words, show that \( \{ \langle G \rangle | G \text{ is a CFG over } \{0,1\} \text{ and } L(1^*) \subset L(G) \} \) is a decidable language.