ToC Question Bank 7

1. Show that the following languages are not CFL.
   i. $L=\{0^i1^j2^i3^j \mid i \geq 1, j \geq 1\}$
   ii. $L = \{0^p \mid p \text{ is a prime}\}$
   iii. $L = \{a^n b^n c^i \mid i \leq n\}$
   iv. $L = \{a^i b^j \mid i \leq j^2\}$
   v. $L = \{a^i b^j c^k \mid k = ij\}$
   vi. $L = (w \text{ belong to } \{a, b, c\}\ n_a(w) < n_b(w) < n_c(w)$
   vii. $L = \{ 0^{2n}1^{3n}0^n \mid n \geq 0 \}$
   viii. $L = \{a^n b^n a^n b^n \mid n >= 0\}$

1. Design Turing Machine to recognize
   a. $L = \{ 0^{2n} \mid n \geq 0 \}$.
   b. $L = \{0^n1^n2^n\}$ where $n \geq 1$
   c. All strings over {0, 1} in which the number "01" pairs is odd.
   d. To check the palindrome of the string of any length.
   e. To add 2 unary numbers separated by a 0.
   f. To get the function c = f(a-b) where and b are two unary numbers separated by a 0 and a is always greater than b.
   g. $L = \{0^i1^j2^k\}$ where i x j = k, I, j, k ≥ 1
   h. Given a list of strings over {0, 1} separated by #, determine if all strings are different.
   i. $q_0w \vdash q_fww^R$
   j. $ww \vdash w\#w$, where w {1}*
   k. $w \vdash w^R$ where w {1}*
   l. $w \vdash w \bmod 2$ where w {1}*
   m. $L = \{(a + b)*b(a + b)*\}$.
   n. $L = \{w\#w' : w \in \{a, b\}* \text{ and w is a substring of } w'\}$.
   o. To accept a string with 'aba' as its substring
   p. $L = \{ b^n a^n b^n \mid n \geq 0 \}$.
   q. $w \in \{a, b, c\}* \mid n_a(w) = n_b(w) \text{ and } n_a(w) > n_c(w)\}$
   r. that changes all the a's on its tape to b's and vice versa
   s. that doubles each character in its input string. For example, if the input is 0100, then the machine should change its tape so it contains 00110000