CSE331: Automata and Computability
Worksheet 5 (CNF and CYK and Turing)

1. Convert the following context free grammars to its equivalent CNF (Chomsky Normal Form) and then use the CYK algorithm to check if the given string belongs to the grammar or not.

a) S → A 1 B

A → 0A | ε

B → 0B |1B| ε

String for CYK: 01011

b) $S \rightarrow aSa \mid aBa$

$B \rightarrow bB \mid b$

String for CYK: abbb

c) S → EcC | aAE | AU
A → aA | ε
B → bB | ε
C → cC | ε
E → aEc | F
F→ bFc | ε
U → aUc | V
V → bVc | bB

String for CYK: aabcc

d) S → aSbb | Z
Z → aZb | ε

String for CYK: aab

e) S → aaaSc | Z

Z → aaZb | ε

String for CYK: aab

2. M is a Turing Machine with following description:

$M = (Q, \Sigma, \Gamma, \delta, q_1, B, q_{accept})$,

$Q = \{q_1, q_2, q_3, q_4, q_5, q_6, q_7, q_8, q_{accept}\}$, $\Sigma = \{0, 1, \#\}$,

Γ = *all symbols on tape* = $\{0, 1, \#, x, B\}$, where B = Blank space

Note: 0/x → means replace 0 with x and move right, 0/x ← means replace 0 with x and move left.

a) Simulate the following turing machine for the input 110#110

b) Will the machine accept the string ?

c) Describe the language of the machine.