(5) Context Free Grammars and DFSA (6 Points)

Consider the context free grammarG = ({X},{a,b},{X → Xa, X → ε, X->b}, X),

where {X} is the set of non-terminals, {a,b} is the set of terminals, {X → 1a, X → ε, X->b} is the set of production rules, and X is the start non-terminal.

Show each string of this language whose length is less than or equal to 6. (3 Points)

“”, “b”, “a”,”ba”,”aa”,”baa”,”aaa”,”baaa”,”aaaa”,”baaaa”,”aaaaa”,”baaaaa”,”aaaaaa”

Draw a Deterministic Finite State Machine over the alphabet Σ = {a,b} that accepts all and only those strings generated by the grammar G. Use an arrow to show the starting state and double circles for any accepting states. Label all transitions.(3 Points)

final

final

b

Loop back on a

b

a

final

Loopback on a or b

b

Loop back

on a

**Solutions may differ**

(6) Context Free Grammars and PDA’s (6 Points)

Consider the context free grammarG = ({X},{0,1},{X → 1X0, X → ε}, X),

where {X} is the set of non-terminals, {0,1} is the set of terminals, {X → 1X0,

X → ε} is the set of production rules, and X is the start non-terminal.

Show each string of this language whose length is less than or equal to 5. (2 Points)

<>, <10>,<1100>

Draw a Push Down Automata over the alphabet Σ = {0,1} that accepts all and only those strings generated by the grammar G. (2 Points)

1, replace e with 1

final

final

0, replace 1 with e

0, replace 1 with e

Using short English sentences, describe the operation of a Turing machine that would accept this language. You need not sketch the automata. Please print neatly. Points will be deducted if it is hard to read. (2 Points)

Scan the tape and make sure it is empty or has a series of 1’s followed by a series of 0’s. If it does not then halt and reject.

Place an X on the leftmost 1 and scan right until the rightmost 0. Replace

the 0 with an X. Repeat.

If, when searching for a rightmost 0, an X is encountered then halt and reject.

If, when searching for a leftmost 1, an X is encountered scan the tape for any additional 0’s. If there are any then halt and reject, there are none so halt and accept.