

CSC 472 Test #2

each problem is worth 10 points

- 1.) Indicate whether each of the following statements is true or false.
There is no need to prove your answer.

true/false

_____ If L is accepted by a PDA with n states then L is
accepted by a DPDA with 2^n states.

_____ $\{a^n b^n c^n \mid n \geq 10\}$ is a CFL.

_____ $\{a^n b^n c^n \mid n \geq 1\}$ is a recursive language.

_____ $\langle M, w \rangle \mid M \text{ halts on input } w\}$ is r.e. l.c.
←

_____ $\langle M, w \rangle \mid M \text{ does not halt on input } w\}$ is r.e.

_____ The set of TM's with tape alphabet $\{0, 1, \sqcup\}$ is countable.

_____ $\{a^i b^j \mid i \neq j \text{ and } i \neq 2j \text{ and } i \neq 3j\}$ is a CFL.

_____ $\{a^i b^j \mid i \text{ is evenly divisible by } j\}$ is a CFL.

_____ Every r.e. language can be generated in canonical order.

_____ If L is a CFL then so is $\text{INIT}(L) = \{z \mid zx \in L \text{ for some string } x\}$.

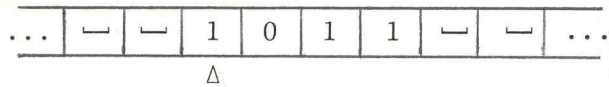
2.) The language $L = \{\text{all well-formed parenthesis strings}\}$ is generated by the grammar

$$S \rightarrow SS | (S) | ()$$

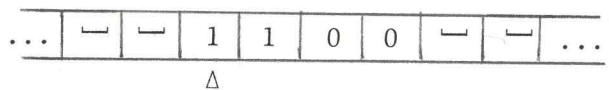
- (a) Give a grammar in Greibach normal form generating L .
- (b) Give a PDA accepting L by empty stack.

- 3.) Design a TM M with a single two-way infinite tape that adds one to a number in binary. Assume that the input is a sequence of 0's and 1's that begins with a 1.

For example, input



produces output



Note that the head ends up at the leftmost non-blank position.

- 4.) Prove that $L = \{a^*bc\} \cup \{a^pba^nca^n \mid p \text{ prime, } n \geq 0\}$ is not a context-free language by using Ogden's lemma. [You will receive extra credit if you can also prove that the pumping lemma is not strong enough to show that L is not context-free.]