

CS 3100 – Models of Computation – Fall 2011

Assignment 9 – Given 11/3/11, Due 11/11/11 FRIDAY 11:59pm – 100 points, 10% of assignment points

1. **(20 points)** Design a CFG for $L_2 = \{a^i b^j c^k \mid i, j, k \geq 0, \text{ if } (i = 1) \text{ then } 0 \leq j - k \leq 1\}$ and test it using JFLAP's brute-force parsing method for input *abbc*. Show the parse tree. Also test it on input *abcc*, showing a failure to parse (use any available method within JFLAP to show the inability to parse). Submit your CFG+Parse Tree as one PDF called *L2CFG_ParseTreeAccept.pdf* and *L2CFG_Reject.pdf*.
2. **(20 points)** Design a PDA for L_2 directly (without converting the CFG to a PDA using direct conversion). Run the PDA on inputs *abbc* and *abcc*, submitting one drawing showing the accepting configuration for the former and rejecting for the latter. Submit files *L2PDA_Accept.pdf* and *L2PDA_Reject.pdf*.
3. **(20 points)** Convert L_2 's CFG from Question 1 to a PDA using direct conversion (*do not take hints from JFLAP which can also do this conversion!!*). Run it on the same inputs as above. Submit files *L2PDAfromCFG_Accept.pdf* and *L2PDAfromCFG_Reject.pdf*.
4. **(20 points)** Simplify the grammar G_4 below, clearly documenting the simplification steps. Argue that the grammar is consistent and complete with respect to the language

$$L_{\text{balpar}} = \{w \mid w \in \{(\,,)\}^*, \text{ and in any prefix } p \text{ of } w, \#_{(}(p) \geq \#_{)}(p), \text{ and } \#_{(}(w) = \#_{)}(w)\}$$

G4:

```
S -> A | B
A -> ( W A | ( X C
B -> ( W B | ( X D
W -> ( W W | ( X Y
X -> ( W X | ( X Z
W -> )
B -> epsilon
```

Please name your submission file Q4.pdf

5. **(20 points)** Find out whether the language of **S** is regular or context-free. If **context-free and not regular**, show that $L(S)$ is not regular by using the Pumping Lemma. *Do a full case analysis for all the situations of y in the Pumping Lemma. You must read my book chapter and not wing a proof from memory. It must work for all possible places at which the looping path y can be placed.*

```
S -> T T | U
T -> 0 T | T 0 | #
U -> 0 U 0 0 | #
```

Please name your submission file Q5.pdf