Name: Rollno:

CSE340: Theory of Computation (Homework Assignment 3)

Due Date: 24th October, 2017 (in class)

Total Number of Pages: 1 Total Points 50

Question 1. Design PDAs for the following languages (give the transition diagram only).

(a) (6 points) $L_1 = \{a^i b^j c^k d^l \mid i = l \text{ and } i + 2j = 3k + l\}$.

(b) (8 points) $L_2 = \Sigma^* \setminus \{ww \mid w \in \Sigma^*\}$. Assume that $\Sigma = \{a, b\}$.

Question 2. One of the following two languages is context-free and one is not.

$$\begin{aligned} L &= \{a^i b^j c^k d^l \mid i = k \text{ and } j = 2l\} \\ M &= \{a^i b^j c^k d^l \mid i = k \text{ or } j = 2l\} \end{aligned}$$

(a) (2 points) Which of the above two languages is context-free?

(b) (6 points) Give a CFG for the language which is context-free

(c) (6 points) Show that the other language is not context-free.

Question 3. Show that the following languages are decidable.

(a) (7 points) $L_1 = \{\langle M \rangle \mid M \text{ is a DFA which does not accept any string that contains 101 as a substring}\}$

(b) (7 points) $L_2 = \{\langle R, S \rangle \mid R, S \text{ are regular expressions and } L(R) \subseteq L(S)\}$

Question 4. (8 points) Show that the following language is decidable

$$L = \{\langle G \rangle \mid G \text{ is a CFG over } \{0, 1\}^* \text{ and } 1^* \subseteq L(G)\}.$$