Model Mid Semester Examination CS203

Full marks – 32

16th February, 2013

Instructions

- 1. You are required to attempt 32 marks worth of questions. Question 1 is compulsory. Every question other than 1 is worth 5 marks. You can attempt as many as you like. Any score higher than 32 will be deemed to have received bonus.
- 2. You are **not** required to prove whether your constructions work, just give two illustrative examples of their execution.

3. Don't Panic.

1. Copy the following text at the very beginning of your answer script and sign below it. [2 marks]

I PROMISE NOT TO COMMIT ANY ACADEMIC DISHONESTY.

2. Construct a Finite Automaton for the following language –

 $L = \left\{ w \in \{0,1\}^* \mid \text{ every 0 in } w \text{ is immediately preceded and followed by 1} \right\}.$

Note: 1101101 and 11 belong to the language, whereas 10 and 01101 doesn't.

3. Let $L \subseteq \{0,1\}^*$ be a language accepted by a finite automaton. Then, construct a finite automaton for the following language –

$$L^R = \left\{ x \mid x^R \in L \right\}.$$

Note: if x is a string, then x^R is defined as the reverse of x. For example, $1010^R = 0101,00001^R = 10000$.

4. Construct a Context-free Grammar for the following language over $\{(,,)\}$ –

L = The set of all strings of balanced parentheses, i.e., each left parenthesis has a matching right parenthesis and pairs of matching parentheses are properly nested.

Note: (())() and (((()))) belong to the language, whereas () and ())() doesn't.

5. Construct a Pushdown Automaton for the following language –

L = The set of all strings over alphabet $\{a, b\}$ not of the form ww for some string w.

Note: ababa and aabbabb belong to the language, whereas abab and aa doesn't.

6. Construct a Finite Automaton for the following language –

 $L = \{ w \in \{0, 1, 2\}^* \mid \text{the sum of the digits of } w \text{ is odd and is a multiple of } 3 \}.$

Note: 011201211 and 012 belong to the language, whereas 222 and 120012 doesn't.

- 7. If $L \in \{a, b\}$ is regular, then $L' = \{x \mid ax \in L \text{ or } xb \in L\}$ is also regular.
- 8. Construct a context-free grammar for the following language –

$$L = \left\{ w \in \{0, 1\}^* \mid \text{contains more 0's than 1's} \right\}.$$

Note: 0 and 11101001000 belong to the language, whereas ϵ and 0110 doesn't.

9. Construct a Pushdown Automaton for the following language –

 $L = \left\{ w \# x \mid x \text{ is a substring of } w^R \right\}.$

Note: 00111#100,00111#111 and 00111#11100 belong to the language, whereas 00111#01 and 1110#10 doesn't.