MID SEMESTER EXAMINATION CS203

Full marks – 32

19th 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 over $\{0,1\}$ –

L = The set of all strings with at most one pair of consecutive 0's and at most one pair of consecutive 1's.

Note: 010101 and ϵ belong to the language, whereas 000 and 0110011 doesn't.

3. Construct a Finite Automaton for the following language –

 $L = \left\{ w \in \{0, 1\}^* \mid w \text{ does not contain the pattern } 01 \right\}.$

Note: 00000 and 11110 belong to the language, whereas 001011 and 110100 doesn't.

4. If L, over some alphabet, is regular, argue whether the following language is regular –

 $INIT(L) = \{x \mid \text{ for some } y, xy \text{ is in } L\}.$

5. If L, over some alphabet, is regular, argue whether the following language is regular –

$$L' = \left\{ xx^- \mid x \in L \right\}.$$

Note: x^- is x without its last symbol. For example, if $\Sigma = \{a, b\}$, then $(aba)^- = ab, (b)^- = \epsilon, (\epsilon)^- = \epsilon$.

6. Construct Context-free grammar for the following language –

L = The set of all strings over alphabet $\{a, b\}$ with exactly twice as many a's as b's.

Note: aab and ϵ belong to the language, whereas aabb and abba doesn't.

7. Construct Context-free grammar for the following language –

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

Note: 01010 and 110100 belong to the language, whereas ϵ and 010010 doesn't.

8. Construct a Pushdown Automaton for the following language –

 $L = \left\{ wx \in \left\{ 0,1 \right\}^* \ | \ w \text{ is a palindrome and } x \text{ is some string } \right\}.$

9. Construct a Pushdown Automaton for the following language over $\{a,b,c\}$ –

$$L = \left\{ a^i b^j c^k \mid i = j \text{ or } j = k \right\}.$$

Note: abc and aabbbccc belong to the language, whereas abbccc and aabbbcc doesn't.