## MID SEMESTER EXAMINATION - CS205M

Part B

Full marks - 67

 $2^{nd}$  October, 2012

- 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. Consider some alphabet  $\Sigma$  and let L be a language over  $\Sigma$ . [3 × 5 marks]
  - (a) If L is regular, argue whether  $L^*$  is regular.
  - (b) If L is the set of all palindromes, argue whether  $L^*$  is regular.
  - (c) If L is not regular, argue whether  $L^*$  is regular.
- 3. If L is a finite subset of  $\Sigma^*$ , where  $\Sigma$  is some alphabet, argue whether L is regular. [10 marks]
- 4. Let  $L_1$  and  $L_2$  are two language over  $\Sigma$ . Define  $L_1 \setminus L_2$  as

$$\{ x \mid x \in L_1 \text{ and } x \notin L_2 \}.$$

If  $L_1$  and  $L_2$  are regular, argue whether  $L_1 \setminus L_2$  is regular. [15 marks]

5. Let G be the grammar

 $S \to aS \mid aSbS \mid \epsilon.$ 

Prove that

 $L(G) = \{ x \mid \text{ each prefix of } x \text{ has at least as many } a$ 's as b's  $\}$ .

[10 marks]

6. Show that if L is regular, so is

$$LOG(L) = \left\{ x \mid \text{ for some } y \text{ with } |y| = 2^{|x|}, xy \text{ is in } L \right\}.$$

[15 marks]