**National University of Computer and Emerging Sciences**

**(Islamabad Campus)**

Department of Computer Science

CS-301 Theory of Automata

Sessional II (Fall 2011)

**Instructor(s):**

Dr. Aftab Maroof, Dr. Waseem Shahzad, Ms. Mehreen Alam

October 24, 2011

**Total Marks: 70 Time Allowed: 1 hour**

Vetted By: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Vetter Signature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* Examination is closed books/notes. No notes, cheat sheets, textbook, or printed material allowed.
* Make sure you have all the 7 Pages.
* Answer only in the space provided. You may use the back side for rough work. You have to return the complete booklet.
* If you believe that some essential piece of information is missing, make an appropriate assumption and use it to solve the problem.

**Roll No: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Section: \_\_\_\_\_\_\_\_\_**

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| --- | --- | --- | --- | --- | --- | --- | --- |
| Question | 1 | 2 | 3 | 4 | 5 | 6 | Total |
| Points | 10 | 10 | 5 | 10 | 25 | 10 | 70 |
| Score |  |  |  |  |  |  |  |

**Question 3: - Marks 5.**

Show that the following Context Free Grammar is ambiguous:

*S-> AA*

*A-> AAA | a | bA | Ab*

**Question 4: - Marks 10.**

State whether the following language is regular or not. Prove your answer using Pumping Lemma.

*{an bm am bn : m, n >= 0}*

**Question 5: - Marks 25.**

Consider the following Grammar *G*

*S -> aS | bS | B*

*B -> bb | C | λ*

*C -> cC | λ*

Apply the following procedures in the order mentioned.

* 1. Convert to Augmented Grammar
  2. Remove null productions
  3. Remove unit/chain productions
  4. Remove useless productions/symbols
  5. Convert the resultant grammar to Chomsky Normal Form (CNF).

**Question 6: - Marks 10.**

Construct a grammar for each of the following over ∑ = {*a, b, c*} whose language is :

1. {*an b2n cm: n, m >0*}
2. { *am bi an : i= m+n* }