**National University of Computer and Emerging Sciences**

**(Islamabad Campus)**

Department of Computer Science

**Signature of Invigilator: \_\_\_\_\_\_\_\_\_\_\_\_ Serial No:\_\_\_\_\_\_\_\_\_**

CS-301 Theory of Automata

Mid-II Examination (Fall 2012)

**Instructor(s):**

Dr. Waseem Shahzad, Ms. Ramoza Ahsan, Ms Mehreen Alam

Nov 12, 2012

**Total Marks: 60 Time Allowed: 1 hour**

Instructions

1. Examination is closed books/notes. No notes, cheat sheets, textbook, or printed material allowed.
2. Make sure you have all the 8 Pages.
3. Answer only in the space provided. You may use the back side for rough work.
4. If you believe that some essential piece of information is missing, make an appropriate assumption and use it to solve the problem.
5. You have to return the complete booklet.
6. Write your name and roll number on each page.

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

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| --- | --- | --- | --- | --- | --- | --- |
| Question | 1 | 2 | 3 | 4 | 5 | Total |
| Points | 15 | 10 | 5 | 20 | 10 | 60 |
| Score |  |  |  |  |  |  |

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

1. **[10 pts]** State whether the following language is regular or not. Prove your answer using Pumping Lemma.

***{an b3m : m, n >= 0}***

1. **[5pts]** Make CFG for the following language.

***{an b2m c4n : m, n >= 0}***

1. **[20pts]** Apply the following procedues.
   1. **[2pts]** Augment the following grammar

**S->Sa|bX**

**X->aX| Λ**

* 1. **[5pts]** Remove null productions from the following grammar

**S->aS|YbY**

**Y->XX**

**X->aX|Λ**

* 1. **[3pts]** Remove unit productions from the following grammar

**S->AB**

**A->B**

**B->aB|Bb|Λ**

* 1. **[5pts]**Remove useless symbols/productions from the following grammar

**S->aX|bX|XV**

**X->a|b| Λ**

**V->aV**

**T->XT**

* 1. **[5pts]**Convert the following grammar to Chomsky’s Normal Form (CNF)

**S->SaS|SaSbS|SbSaS| Λ**