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| Serial No: |
| **Sessional II** |
| **Total Time: 1 Hour** |
| **Total Marks: 60** |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Signature of Invigilator |

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| **CS 301 Theory of Automata** |
| Saturday, Nov 2, 2013 |
| **Course Instructor** |
| Dr. Waseem Shahzad and Ms. Mehreen Alam |

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## DO NOT OPEN THE QUESTION BOOK OR START UNTIL INSTRUCTED.

**Instructions:**

1. Attempt on question paper. Attempt all of them. Read the question carefully, understand the question, and then attempt it.
2. No additional sheet will be provided for rough work. Use the back of the last page for rough work.
3. If you need more space write on the back side of the paper and clearly mark question and part number etc.
4. After asked to commence the exam, please verify that you have ten (10) different printed pages including this title page. There are total of 5 questions.
5. Use permanent ink pens only. Any part done using soft pencil will not be marked and cannot be claimed for rechecking.

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| --- | --- | --- | --- | --- | --- | --- |
|  | Q-1 | Q-2 | Q-3 | Q-4 | Q-5 | **Total** |
| **Marks Obtained** |  |  |  |  |  |  |
| **Total**  **Marks** | 15 | 15 | 15 | 5 | 10 | **60** |

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

**Question 2:**

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

***{an b3m cm d2n : m, n >= 0}***

1. Show that the following Context Free Grammar is ambiguous:

**S -> aS | bS | aaS | λ**

**Question 3:- Marks 3+4+4+4.**

Apply the following procedures.

1. Augment the following grammar.

**S -> SS | X**

**X -> aX | Λ**

1. Remove null productions from the following grammar.

**S -> XaX | bX**

**X -> XaX | XbX | Λ**

1. Remove unit productions from the following grammar.

**S -> X**

**X -> Y**

**Y -> Z**

**Z -> aa | bb**

1. Remove useless symbols/productions from the following grammar.

**S -> aX | bY | XY**

**X -> a | b | Λ**

**Y -> aY | YY**

**T -> aa | bb**

**Question 4:- Marks 5.**

Convert the following grammar to Chomsky’s Normal Form (CNF).

**S -> aXX**

**X -> aS | bS | a**