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| Serial No: |
| **Sessional II** |
| **Total Time: 60 minutes** |
| **Total Marks: 70** |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Signature of Invigilator |

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| **CS301-Theory of Automata** |
| Saturday, Oct 21, 2017 |
| **Course Instructor** |
| Dr Waseem Shehzad, Dr Labiba Fahad, Ms. Mehreen Alam |

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| **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  Student Name Roll No Section Signature |

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

**Instructions:**

1. Understanding the question paper is also part of the exam, so do **not** ask any clarification.
2. The question paper is printed on both sides of the pages.
3. Attempt all questions on the same sheets/pages and within the space provided with each question. You may lose marks if you write in extra space.
4. Make sure that this question paper contains five **(05)** pages including title page. Be brief, smart and efficient!
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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| --- | --- | --- | --- | --- | --- | --- |
| Question | 1 | 2 | 3 | 4 | 5 | **Total** |
| **Marks Obtained** |  |  |  |  |  |  |
| **Total**  **Marks** | 20 | 10 | 10 | 20 | 10 | **70** |

**Vetted By: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Vetter Signature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Q1. [5+5+10 = 20 pts] Kleene’s Theorem**

1. Convert the following TG to an RE.
2. Convert the following RE to FA using the method studied in the class.

**a+(b+ab)\***

1. Minimize the following FA using the method studied in the class.

**Q2. [ 10 pts] Use Pumping Lemma to prove if the following language is regular.**

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

**Q3. [ 10 pts] Convert the following Moore Machine to its equivalent Mealy Machine.**

**Q4. [2+4+4+6+4= 20 pts] Perform the following steps on the grammar given below in the order mentioned.**

**S -> aS | bS | B**

**B -> bb | C | λ**

**C -> aC**

**D -> aC | CC | b**

**F -> SS | BC | b**

1. Augment
2. Kill null-productions
3. Kill unit-productions
4. Remove useless symbols/productions (both methods)
5. Convert the resultant grammar to CNF

**Q5. [5+5 = 10 pts] Design CFGs for the following languages.**

1. **anamb4m bn**
2. **EQUAL-EQUAL where every word has equal number of a’s and b’s**