# ALLAMA IQBAL OPEN UNIVERSITY, ISLAMABAD
## (Department of Computer Science)

**WARNING**

1. **PLAGIARISM OR HIRING OF GHOST WRITER(S) FOR SOLVING THE ASSIGNMENT(S) WILL DEBAR THE STUDENT FROM AWARD OF DEGREE/CERTIFICATE, IF FOUND AT ANY STAGE.**
2. **SUBMITTING ASSIGNMENTS BORROWED OR STOLEN FROM OTHER(S) AS ONE'S OWN WILL BE PENALIZED AS DEFINED IN "AIOU PLAGIARISM POLICY".**

**Course: Theory of Automata (3452)** **Semester: Spring, 2014**
**Level: Bachelor** **Total Marks: 100**

# ASSIGNMENT No. 1

**Note: All questions carry equal marks.**

Q.1 a) Define Theory of Automata and write down the detailed history of Automata. Also elaborate the importance of Automata Theory.
b) Show that there are infinitely many different recursive definitions for the set EVEN.

Q.2 a) Write five difference and five similarities between DFA and NFA.
b) Define context free Grammar and Context Free Language. Elaborate each with an example.

Q.3 What is parsing? Differentiate top-down & bottom up parsing with examples. Also explain top-down techniques with examples.

Q.4 a) Differentiate directed and undirected graphs with examples.
b) Find the language generated by the following CFG:
$S \rightarrow aSa$
$S \rightarrow \Lambda$
$S \rightarrow b$

Q.5 Elaborate the following with examples:
a) Regular sets and Regular expression
b) Recursive Definitions
c) Strings and Languages
d) Reducer Parser

# ASSIGNMENT No. 2

Q.1 What is Finite Automata? Write down the two types of FA with respect to output. Also build a FA that accepts only the words *baa, ab, abb* or *aab* and no other strings longer or shorter.

Q.2 For each of the following pairs of regular languages; find a regular expression and FA that each define $L_1 \cap L_2$.

| | $L_1$ | $L_2$ |
|---|---|---|
| a) | (a+b)b(a+b)* | (a+b)*aa(a+b)* |
| b) | (ab*)* | b(a + b)* |
| c) | Even length string | a(a +b)* |
| d) | Odd length string | a(a+b)* |

Q.3 Define Turing Machine and explain standard Turing machine with examples. Also build a Turing Machine that accepts the language of all words that contain the substring *bbb*.

Q.4 a) Build a deterministic push down automata to accept the language $\{a^n b^{n=1}\}$.

b) Find a push down automata that accepts all PALINDROMES where the alphabet is $\Sigma = \{a,b\}$/

Q.5 Elaborate the following with examples:

a) Standard Turing Machines
b) Greibach Normal Form
c) Chomasky Normal Form
d) Lamba Chain Rules
e) Closure Properties of Regular languages

## 3452 Theory of Automata — Credit Hours: 3 (3 +0)

**Recommended Book:**
**Introduction to Computer Theory by Denial I. A. Cohen**

**Course Outline:**

**Unit No.1 Mathematical Preliminaries**
Set theory, Relations and Functions, Recursive Definitions, Direct Graphs and Mathematics

**Unit No.2 Languages**
Strings and Languages, Finite Specification of Languages, Regular Sets and Expression

**Unit No.3 Context-Free Grammars**
Context-free Grammars and Languages, Regular Grammar and Arithmetic Expression

**Unit No.4 Parsing**
Leftmost Deviations and ambiguity, Regular Grammars, Bottom-up Parsing Shift Reducer Parser.

**Unit No.5 Normal Forms**
Elimination of Lambda Chain Rules, Chomaky Normal Form, Greibach Normal Form.

**Unit No.6 Finite Automata**
Finite State machine, Deterministic Finite Automata, Nondeterministic Finite Automata, Lambda Transitions, Expression Graphs

**Unit No.7 Regular Languages**
Regular Grammar and finite Automate, Non-regular
Language, Pumping Lemma for Regular Language, Closure Properties or Regular Language

**Unit No.8 Pushdown Automata and Context-Free Languages**
Pushdown Automata, Pushdown Automata and Context-free Language, pumping Lemma for Context-Free Languages.

**Unit No.9 Turing Machine**
Standard Turing Machine, Multiple Machines, Nondeterministic, Turing Machines.