ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
Department of Computer Science and Engineering (CSE)

FINAL SEMESTER EXAMINATION **SUMMER SEMESTER, 2019-2020**

DURATION: 1 Hours **FULL MARKS: 45**

CSE4309: Theory of Computing

Write your **Name, Student-ID, and Course Code** on the top of the first page.
Put a serial number on the Top-right corner of each page and rename the pdf file with your **Student-ID**
There are **3 (three)** questions. Answer **All** of them. Figures in the right margin indicate marks.

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1. (a) Design Context Free Grammar for the following languages where T = {a, b}: 5*2=10
   a. The set of all strings where the length of string is odd, and the middle symbol is a.
   b. The set of all strings with an equal number of a's and b's.

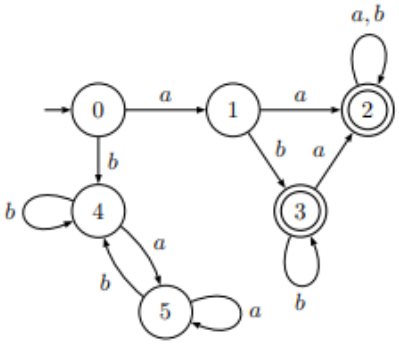
   (b) Consider the grammar: 2.5*2=5
   $E \rightarrow +EE \mid *EE \mid -EE \mid x \mid y$
   Find the following from the grammar for the string "$+*-xyxy$":
   i. Right most derivation
   ii. Parse tree

2. (a) Design a PDA to accept the language, L = $\{a^i b^j c^k \mid i = j \text{ or } j = k\}$ and show the diagram and transition function for the constructed PDA. 7

   (b) Obtain PDA equivalent to the following grammar: 4*2=8
   i. $E \rightarrow E + E \mid E * E \mid id$
   ii. $S \rightarrow aABC$
   $A \rightarrow aB \mid a$
   $B \rightarrow bA \mid b$
   $C \rightarrow a$

3. (a) Explain the 7-tuple definition of Pushdown Automata (PDA). 3

   (b) Construct the minimum-state equivalent DFA using table filling algorithm 7



   (c) Show that the following grammar is ambiguous on the string "ibtibtaea" 5
   $S \rightarrow iCtS \mid iCtSeS \mid a$
   $C \rightarrow b$