United International University (UIU)

Dept. of Computer Science & Engineering (CSE)

Final Exam : Trimester: Summer 2020

Course Code: CSI 233/CSE 2233, Course Title: Theory of Computing

Total Marks: 25 Duration: 1 hour 15 minutes

There are 3 questions. Answer all questions. Any examinee found adopting any unfair means will be expelled from the trimester/program as per UIU disciplinary rules.

1. (a) Draw the schematic diagram of a Pushdown Automata that can detect the following language.[CO2] [4]

   $L=\{ a^p b^q c^r \mid p + q < r \text{ and } p, q, r > 0 \}$

   (b) Write the components (formal definition) of the PDA you have designed in question 1(a). [CO2] [2]

2. (a) Draw the schematic diagram of a deterministic Turing Machine that can detect the following language.[CO4] [4]

   $L=\{ 0^n \# 1^n \mid n > 0 \}$

   (b) Find out whether the following string is accepted by the Turing Machine you have designed in question 2(a). Show Instantaneous description of the input tape for each transition. [CO4] [2]

   i) 00#11

3. (a) Find the language of the following Context Free Grammar [CO1] [2]

   $S \rightarrow aaaS_1b \mid \epsilon$

   (b) Design a Context Free Grammar for the following language.[CO2] [3]

   L= (01+1)*001*

   (c) Find out whether the following Context Free Grammar is ambiguous or not using the string 01101? If your Context Free Grammar is ambiguous, show two different parse trees for this string. [CO2] [4]

   $S \rightarrow S_1S_210S_1$

   $S_1 \rightarrow 1S_1 \mid 0S_1 \mid \epsilon$

   $S2 \rightarrow 1S_2 \mid 0S_2 \mid 0 \mid 1$

   (d) Convert the following Context Free Grammar to a Chomsky Normal Form[CO3] [4]

   $S \rightarrow AC01 \mid 0S \mid 1S \mid A1$

   $A \rightarrow B \mid CA \mid \epsilon$

   $C \rightarrow 0 \mid 1$

   $B \rightarrow 11B \mid 00B \mid \epsilon$