



COLLEGE
(A Constituent College of Chuka University)
UNIVERSITY EXAMINATIONS

**EXAMINATION FOR THE AWARD OF DEGREE OF
BACHELOR OF SCIENCE IN COMPUTER SCIENCE**

COSC 340: THEORY OF COMPUTATION

STREAMS: BSC (COSC)

TIME: 2 HOURS

DAY/DATE: WEDNESDAY 08/04/2020

11.30 AM – 1.30 PM

INSTRUCTIONS:

- Answer **QUESTION 1** and any other **TWO QUESTIONS** from section B.
- This is a **CLOSED BOOK EXAM**, No reference materials allowed in examination room. Mobile phones must be switched off.
- Do not write on this question paper
- Write your answers legibly and use your time wisely.
- Scientific, non-programmable Calculators may be used.

SECTION A: COMPULSORY

QUESTION 1 [30MKS]

- a) Explain what theory of computation deals with (2 marks)
- b) Define the following terms giving an example of each
- Alphabet(Σ) (2 marks)
 - String over an alphabet Σ (2 marks)
 - Empty strings(ϵ) (2 marks)
 - Power of an alphabet Σ^* (3 marks)
 - Language over an alphabet (L) (3 marks)
- c) What is an NP Complete problem? Give an example of an NP Problem? (4 marks)
- d) Write the regular expression for the language accepting all combinations of a's, over the set $\Sigma = \{a\}$ (4 marks)

- e) What is a derivation tree? Draw a derivation tree for the string "bab" from the CFG given by $S \rightarrow bSb \mid a \mid b$ (4 marks)
- f) Construct the CFG for the language having any number of a's over the set $\Sigma = \{a\}$. (4 marks)

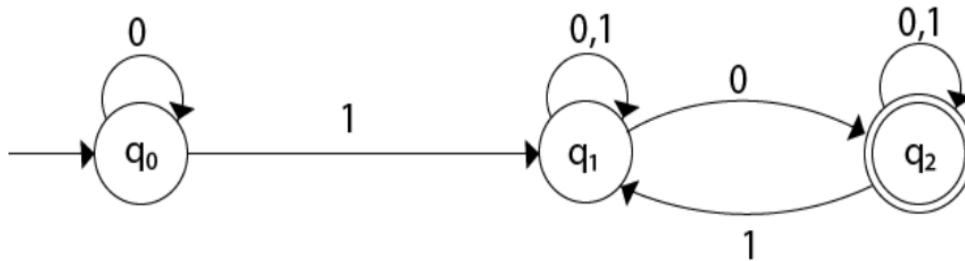
SECTION B: ATTEMPT ONLY TWO QUESTIONS FROM THIS SECTION

Question 2 (20 marks)

- a) What do you understand from the following terms as used in theory of computation? (6 marks)
 - (i) Regular expression
 - (ii) Context free grammar
 - (iii) Ambiguous grammar
- b) Construct a TM machine for checking the palindrome of the string of even length. The string is ababbaba Δ . (9 marks)
- c) Using a diagram if necessary, explain the FIVE operations of Turing machine. (5 marks)

Question 3 (20 marks)

- a) Give a formal definition of a Deterministic Finite Automata (DFA) (5 marks)
- b) Convert the given NFA to DFA. (10 marks)



- c) Explain the pumping lemma for regular and non-regular languages (5 marks)

Question 4 (20 marks)

- a) Using a suitable diagram discuss Chomsky Hierarchy. (10 marks)
- b) Write the regular expression for the language starting and ending with **a** and having any combination of **b**'s in between. (5 marks)
- c) Write the regular expression for the language starting with **a** but not having consecutive **b**'s. (5 marks)

Question 5 (20 marks)

a) Briefly describe the following terms as used in theory of computation. (10 marks)

- (i) P Problem
- (ii) Non-deterministic Finite automata
- (iii) Turing machine
- (iv) Push Down Automata
- (v) Deterministic Finite automata

b) Draw a state diagram to show how the machine responds to the following input

(i) abbab (5 marks)

(ii) baabba (5 marks)
