CHUKA  **UNIVERSITY**

RESIT/SPECIAL EXAMINATION

THIRD YEAR FIRST SEMESTER RESIT/ SPECIAL EXAMINATION FOR THE AWARD OF BACHELOR OF SCIENCE COMPUTER SCIENCE / BACHELOR OF SCIENCE APPLIED COMPUTER SCIENCE

COSC 340 / COMP 303: THEORY OF COMPUTATION

STREAMS: BSC COMP SCI / BSC APPLIED COMP SCI

TIME: 2 HOURS

DAY/DATE: MONDAY 01/11/2021 **8.30 A.M – 10.30 AM**

INSTRUCTIONS:

- Answer Question **ONE** and any other **TWO** questions.
- Diagrams should be used whenever they are relevant to support an answer.
- Sketch maps and diagrams may be used whenever they help to illustrate your answer
- Do not write anything on the question paper
- This is a **closed book exam**, No reference materials are allowed in the examination room
- There will be **No** use of mobile phones or any other unauthorized materials
- Write your answers legibly and use your time wisely

SECTION A

ANSWER ALL QUESTIONS IN THIS SECTION

QUESTION ONE [30 MARKS]

a) Using appropriate diagrams, differentiate between Deterministic Finite Automaton and Non Deterministic Finite Automaton [6 Marks]

b) Describe the features of a Turing Machine [3 marks]

c) You are given the language $\{a^n b^n | n>=1\}$

i. Describe this language [2 Marks]
ii. Is the language regular or irregular? [1 Mark]
iii. Justify your answer given in ii) above [3 Marks]
iv. Identify and discuss the computational machine able to process the specified language [3 Marks]

d) Describe a computation Algorithm with reference to the Church-Turing thesis [6 Marks]

e) Giving an example for each differentiate between a set and a tuple [6 Marks]

SECTION B

ANSWER <u>ANY TWO</u> QUESTIONS FROM THIS SECTION

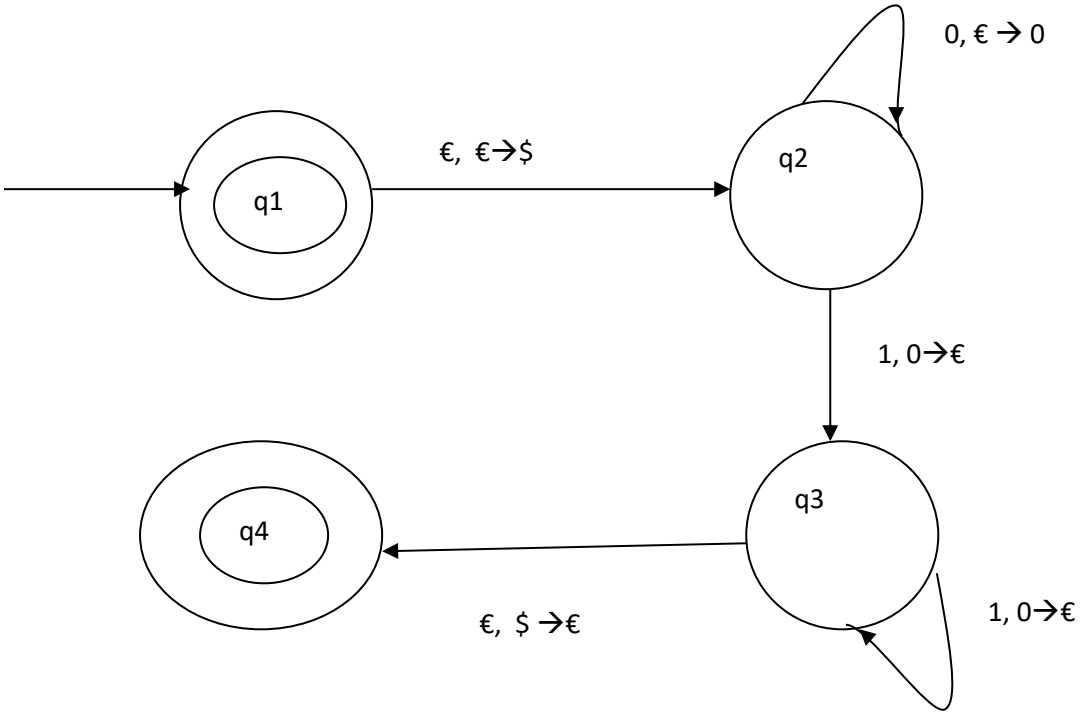
QUESTION TWO [20 MARKS]

An Automatic door is one real life implementation of Finite Automaton computational model.

i. Explain the workings of an Automatic door [4 marks]
ii. Present the State diagram of an Automatic door [6 Marks]
iii. Formally define the State diagram of the Automatic door [10 Marks]

QUESTION THREE [20 MARKS]

a) A pushdown Automata PDA P is presented as follows:



Making reference to the Push Down Automaton above:

i. Formally define PDA P [8 Marks]

ii. Explain the actions represented by transitions
   i. q1→q2
   ii. q3→q4
   [8 Marks]

iii. Discuss the computation of PDA P [4 marks]

QUESTION FOUR [20 MARKS]

a) Differentiate between complexity classes P and NP. Discuss [6 Marks]

b) Explain the relationship between cryptography and the theory of complexity [4 Marks]

c) Describe the relationship between a computer virus and the theory of computability [4 Marks]

d) Let B be the set of all infinite sequences over {0, 1}. Show that B is uncountable, using a proof by diagonalization. [6 Marks]

QUESTION FIVE [20 MARKS]

a) Assume we have two regular languages L (A) = {boy, girl} and L (B) = {good, bad}. Show the results of the regular operations below on the two languages:

   i. Conjunction of Language L(A) and Language L(B) [3 Marks]

   ii. Star of Language L(B) [3 Marks]

   iii. Union of Language L(A) to L(B) [3 Marks]

b) Differentiate between Acceptable Languages and Recognizable Languages [4 marks]

c) Differentiate between Enumerators and Deciders as classes of Turing Machines [4 marks]

d) List and explain any three areas where Context Free Grammars are used [3 Marks]
