



**NATIONAL OPEN UNIVERSITY OF NIGERIA**  
**University Village, 91 Cadastral Zone, Nnamdi Azikwe Expressway, Jabi, Abuja**  
**FACULTY OF SCIENCES**  
**APRIL, 2019 EXAMINATIONS**

**COURSE CODE:** CIT342

**COURSE TITLE:** Formal Languages and Automata Theory

**CREDIT:** 3 Units

**TIME ALLOWED:** 2½ Hours

**INSTRUCTION:** Answer Question 1 and any other FOUR (4) Questions

- 1a) Distinguish between a word and a vocabulary in formal language. Use examples to illustrate your answer **(3 marks)**
- b) Let  $V$  be a set of strings. Is  $V^+ = V^*$ ? Justify your answer. **(3 marks)**
- c) Enumerate the components of a formal grammar. **(4 marks)**
- d) Compare context-free grammar and regular grammar **(4 marks)**
- e) Differentiate between an alphabet and a language **(2 marks)**
- f) Enumerate any **two** of the typical questions being asked about formalism in formal language theory. **(2 marks)**
- g) Define automata theory. **(2 marks)**
- h) State the **two** ways of implementing a DFA. **(2 marks)**
- 2a) Formally define an automaton **(5 marks)**
- b) Briefly describe any two of the popular variations in the definition of different components of automata. **(7 marks)**
- 3a) List any four types of automata and state their respective recognizable language. **(6 marks)**
- b) In the context of automata theory, briefly describe the following terms:
- i. Recognised language **(2 marks)**
  - ii. Run **(2 marks)**
  - iii. Transducer **(2 marks)**
- 4a) Thinking of an automaton as a computer, state the way(s) it can handle non-determinism? **(2 marks)**

- b) Is a Non-Deterministic Finite Automaton (NFA) more powerful than a Deterministic Finite Automaton (DFA)? Explain. **(4 marks)**
- c) State the precedence of the following with respect to regular expressions: **(2 marks)**
- i) Kleene Star
  - ii) Concatenation
  - iii) Union
  - iv) Parentheses
- d) Briefly explain the concept of ambiguity in grammars. **(4 marks)**
- 5a) Describe the types of Push Down Automata (PDAs). **(3 marks)**
- b) Give the formal definition of a PDA **(4 marks)**
- c) List any two ways of defining a language **(2 marks)**
- d) Enumerate any two of the mathematical concepts needed to proof the Halting Problem. **(3 marks)**
- 6a) What does it mean to say a formally stated problem is:
- i) Unsolvable? **(1 mark)**
  - ii) Provably unsolvable? **(1 mark)**
  - iii) Undecidable? **(1 mark)**
- b) State the Halting Problem. **(2 marks)**
- c) (i) State Godel incompleteness theorem. **(2 marks)**  
(ii) Basically, what did Godel prove? **(2 marks)**
- d) When is formal system said to be:
- i) Complete? **(1½ marks)**
  - ii) Inconsistent? **(1½ marks)**