



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

COURSE CODE: CIT445

COURSE TITLE: Principles and Techniques of Compilers

CREDIT: 3 Units

TIME ALLOWED: 2½ Hours

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

- 1a) Define formal language **(3 marks)**
b) State three areas of application of formal languages **(3 marks)**
c) Define translator, hence, state the advantages of a translator in computing. **(4 marks)**
d) Enumerate the functions performed by the lexical analyser **(4 marks)**
e) State four benefits of LR parsing **(6 marks)**
f) Define FIRST(α) for any given grammar? **(2 marks)**
- 2a) Briefly describe the operation performed by the shift-reduce parser **(6 marks)**
b) Given the context-free grammar G below:

G: $E \rightarrow E + E$
 $E \rightarrow E * E$
 $E \rightarrow (E)$
 $E \rightarrow id$

State the steps performed by the shift-reduce parser when analyzing the input string:

$id_1 + id_2 * id_3$ **(6 marks)**

- 3a) List the common techniques for building tables for an “LR” parser stating the characteristics of each? **(6½ marks)**
b) Consider the grammar,

G: $E \rightarrow E + T \mid T$
 $T \rightarrow T * F \mid F$
 $F \rightarrow (E) \mid i$

What is the augmented grammar for this grammar. **(2 marks)**

- c) Explain what is meant by the term Viable Prefix? **(3½ marks)**

- 4) Consider the grammar G below:

G: $E \rightarrow E + T / T$

$T \rightarrow T * F / F$

$F \rightarrow (E) / i$

i) Generate the non-left recursive version of the grammar **(5 marks)**

ii) Find FOLLOW of all the non-terminal symbols in the non-left recursive version of the grammar **(7 marks)**

5a) Given the grammar G with the following production rules, $S \rightarrow a \mid aS \mid bS$, determine whether the string ***aababbba*** can be generated by the grammar **(6 marks)**

b) Enumerate any three of the errors which can be detected during lexical analysis **(6 marks)**

6) Consider the grammar,

G: $S \rightarrow a \mid aS \mid bS$

a) Find the LR(0) items for this grammar **(9 marks)**

b) Construct an NFA whose states are the LR(0) items from (a) above. **(3 marks)**