NATIONAL OPEN UNIVERSITY OF NIGERIA
University Village, 91 Cadastral Zone, NnamdiAzikwe Expressway, Jabi, Abuja
FACULTY OF SCIENCES
COMPUTER SCIENCE DEPARTMENT
2022_1 EXAMINATION

COURSE CODE: CIT445
COURSE TITLE: Principles and Techniques of Compilers
CREDIT: 3 Units
TIME ALLOWED: 3 Hours
INSTRUCTION: Answer Question 1 and any other three (3) questions

1a) What do you understand by the term "formal language") **3 marks**
b) Formal languages can be used in several ways. State any three of these uses) ***4½ marks***
c) What is a translator?) **3marks**
d) State two needs for translators in programming) **3 marks**
e) Outline any three roles of the lexical analyser in the compilation process) ***4½ marks***
f) Briefly describe the operation performed by the shift-reduce parser) **7 marks**

2a) Given the context-free grammar G:

G: $E \rightarrow E - E$
$E \rightarrow E / E$
$E \rightarrow (E)$
$E \rightarrow i$

In a tabular form, outline the steps performed by the shift-reduce parser when analyzing the input string:
$\mathbf{i}_1 - \mathbf{i}_2 / \mathbf{i}_3$) 11 marks

b) State two benefits of LR parsing?) 4 marks

3a) There are several techniques for building tables for an "LR" parser. Outline the three common ones with two characteristics of each? ***) 6½ marks***
b) Consider the grammar,

G: $E \rightarrow E - T \mid T$
$T \rightarrow T/F \mid F$
$F \rightarrow (E) \mid a$

Give the augmented grammar for this grammar.) 4½ marks

c) What are the knowledge required to build a compiler? ***(4 marks)***

4) Consider the grammar G:

G: E → E - T / T
T → T / F / F
F → (E) / a

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

b) Find FOLLOW of all the nonterminal symbols in the non-left recursive version of the grammar) **7 marks**

c) What is meant by Viable Prefix? ***) 3 marks***

5a) Given the grammar *G* with following production rules, S → b | bS | cS, can the string ***bbcbcccb*** be generated by the grammar? ***) 5marks***

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

c) State the function(s) of the following phases of compiler:

i) Code optimization ***(2 marks)***

ii) Code generation ***(2 marks)***

6) Consider the grammar,

G: S → a | aS | bS

a) Find the LR(0) items for this grammar) 10 marks

b) Construct an NFA whose states are the LR(0) items from (a).) 5 marks