



MACHAKOS UNIVERSITY

University Examinations for 2019/2020 Academic Year

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COMPUTING AND INFORMATION TECHNOLOGY

THIRD YEAR SECOND SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (COMPUTER SCIENCE)

SCO 301: COMPILER CONSTRUCTION

DATE: 16/11/2020

TIME: 2.00-4.00 PM

INSTRUCTIONS

Answer question ONE and any other TWO questions.

QUESTION ONE (30 MARKS)

- a) When programming occasionally the computer generates bugs
 - i) Describe three types of errors that may arise during programming (6 marks)
 - ii) Of the errors that you have listed above, which ones does the compiler recognize and which ones doesn't it recognize (3 marks)
- b) Define what a programming language is and describe token that you can find in any language with examples (4 marks)
- c) Describe the work of the lexical analyzer (2 marks)
- d) Define what are regular expressions and TWO possible operations carried on them (3 marks)
- e) Describe the component of a Grammar and Outline Chomsky Hierarchy of Grammars (6 marks)
- f) Outline the requirement for a grammar to satisfy a Context Free Grammar (3 marks)
- g) Describe THREE language problems (3 marks)

QUESTION TWO (20 MARKS)

- a) Symbolically define a Digit, letter and Identifier (6 marks)
- b) With respect to a programming Language of your choice,
 - i. Write a function that can be used to recognize all words that start with a digit (5 marks)
 - ii. Write a function that can detect whether a word contain the following characters { +, *, %, #, & } (5 marks)
 - iii. Write a program that would call the above two functions and state whether a given input string is a valid identifier or not (4 marks)

QUESTION THREE (20 MARKS)

- a) Describe THREE parser Operations (3 marks)
- b) Define a CFG (4 marks)
- c) Using Normal English where a $S \rightarrow NP VP$ where NP is Noun Phrase and VP is Verb Phrase, construct the Parse tree for The man read this book (7 marks)
- d) The most common features of a parser are that it must be sound, complete and terminates. Describe these features (6 marks)

QUESTION FOUR (20 MARKS)

- a) Given the following grammar of algebraic expressions

- 1. $S \rightarrow x$
- 2. $S \rightarrow y$
- 3. $S \rightarrow z$
- 4. $S \rightarrow S + S$
- 5. $S \rightarrow S - S$
- 6. $S \rightarrow S * S$
- 7. $S \rightarrow S / S$
- 8. $S \rightarrow (S)$

Show how it can generate the following input string

- i. $(x + y) * x - z * y / (x + x)$ (8 marks)
- ii. Draw the respective parse tree for it (4 marks)

b) Using the following grammar

1. $S \rightarrow SS$

2. $S \rightarrow ()$

3. $S \rightarrow (S)$

4. $S \rightarrow []$

5. $S \rightarrow [S]$

derive the following sequence $([[[() [[]]] ([]))$

(6 marks)

c) Describe 2 language problems

(2 marks)

QUESTION FIVE (20 MARKS)

a) Give the following grammar

1. $S \rightarrow E+T$

2. $E \rightarrow T$

3. $T \rightarrow E-T$

4. $T \rightarrow F$

5. $F \rightarrow E * F$

6. $F \rightarrow id$ identify and eliminate the left recursion

(12 marks)

b) Given the following grammar,

1. $E \rightarrow T E'$

2. $E' \rightarrow + T E' \mid \epsilon$

3. $T \rightarrow F T'$

4. $T' \rightarrow * F T' \mid \epsilon$

5. $F \rightarrow (E) \mid id$

i. Define the FIRST and FOLLOW

ii. Construct the Look-up table

(8 marks)