



SOUTH EASTERN KENYA UNIVERSITY
UNIVERSITY EXAMINATIONS 2016/2017

**SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF
SCIENCE IN COMPUTER SCIENCE
CSC 421: COMPILER CONSTRUCTION**

DATE: 13TH APRIL, 2017

TIME: 4.00 -6.00 PM

INSTRUCTIONS TO CANDIDATES

- a) Answer **ALL** questions from section A(Compulsory)
b) Answer **ANY TWO** questions from section B
-
-

SECTION A - Compulsory
Question 1

- (a) (i) State four typical components that defines a programming language. **(2 marks)**
(ii) Differentiate between compilers and interpreters as used in programming. **(4 marks)**
- (b) (i) *Program compilation must be made of analysis and synthesis.* Justify this statement with respect to compilers. **(4 marks)**
(ii) Study the following programming language grammar.
E → E * E
E → num
- I. Justify that the grammar is ambiguous. **(4 marks)**
II. Resolve the ambiguity using a left recursive reference. **(4 marks)**
- (c) (i) Describe two possible outputs of semantic analysis during compilation. **(4 marks)**
(ii) With the aid of illustrations, distinguish between inherited and synthesized attributes as used in compilers. **(4 marks)**
- (d) With the aid of an illustration, describe predictive parsing. **(4 marks)**

SECTION B (40 MARKS)

Answer *two* questions from this section

Question 2

- (a) The following is a C++ program segment. Use it to answer the questions that follow.

```
for (index=0; index<=4; index++)  
    Sum= Sum + marks
```

- (i) Outline three typical steps necessary when scanning the segment. **(3 marks)**
(ii) Scan the segment and generate the appropriate output. **(3 marks)**
(iii) Represent the structure of the statement to be executed using a parser tree. **(2 marks)**
- (b) (i) A lecturer advised his students to distinctively design the first two phases of their compiler construction project. Explain two reasons that could have influenced this advice. **(4 marks)**
(ii) Outline four possible values of the following regular expression and represent it using an NFA.
 $(a|b)^*ac$ **(5 marks)**
(iii) Convert the NFA in (ii) to a DFA. **(3 marks)**

Question 3

- (a) (i) Write a regular expression that could be used for the following categories:
I. variable names;
II. signed integers. **(4 marks)**
- (ii) Define context free grammar for each of the following regular expressions:
I. a^*
II. $b^?$ **(4 marks)**
- (iii) Assuming leftmost derivation, draw a parser tree to represent the string aabbcc given the following grammar. **(3 marks)**
 $T \rightarrow R$
 $T \rightarrow aTc$
 $R \rightarrow$
 $R \rightarrow RbR$
- (b) (i) John would like to implement semantic analysis in his compiler project. Explain how he would achieve this objective. **(6 marks)**
- (ii) Explain three advantages of a compiler using intermediate code. **(3 marks)**

Question 4

- (a) Code optimization increases the efficiency of compilers.
- (i) Describe two stages where this feature can be implemented. **(4 marks)**
 - (ii) With the aid of an illustration in each case, explain three ways of implementing this feature in compilers. **(9 marks)**
- (b) Discuss the following types of parsers:
- (i) LL(1); **(3 marks)**
 - (ii) SLR. **(4 marks)**