



MACHAKOS UNIVERSITY

University Examinations for 2022/2023 Academic Year

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COMPUTING AND INFORMATION TECHNOLOGY

THIRD YEAR SECOND SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (COMPUTER SCIENCE)

SCO301: COMPILER CONSTRUCTION

DATE: 13/4/2023

TIME: 11:00 – 1:00 PM

INSTRUCTIONS: ANSWER QUESTION ONE AND OTHER TWO QUESTIONS

QUESTION ONE (COMPULSORY) (30 MARKS)

- a) Distinguish between the following concepts; (3 marks)
- Assembler
 - Compiler
 - Interpreter
- b) Summarize how context-free grammars are specified in compiler construction. (3 marks)
- c) Explain TWO roles of the lexical analyzer in compiler construction. (4 marks)
- d) Describe TWO methods for improving a program in compiler construction through the function preserving transformations. (4 marks)
- e) Explain the types of activation records that can be used to store necessary information required in a compiler construction to call a procedure depending on the source language used. (4 marks)
- f) Explain TWO characteristics of peephole optimization in compiler construction. (4 marks)
- g) Outline FOUR roles of the IR generator. (4 marks)
- h) Use the Directed Acyclic Graph to evaluate the following; (4 marks)

$$a + a * (b - c) + (b - c) * d$$

QUESTION TWO (20 MARKS)

- a) Discuss FOUR reasons for using the regular expression to define the lexical syntax of a language. (8 marks)
- b) Outline FOUR common issues that arise during the code generation phase in compiler construction. (4 marks)
- c) The lexical- (scanner), syntactic- (parser), and semantic-analysis phases of a compiler front-end each process parts of the source program in particular ways and also check certain rules of the language being compiled. For each of the following possible language rules, specify which phase of the compiler should verify that a program conforms to that rule and why that part of the compiler is the best place for that check. If a check could be done equally well in more than one phase of the compiler, briefly discuss the tradeoffs between the alternative implementations. Keep your answers short and to the point.
 - i. A function is called with the correct number of arguments. (2 marks)
 - ii. Underscore characters (`_`) may appear in the middle of identifiers, but not at the beginning or end (i.e., `this_identifier` is legal, but `_this_one` is not). (2 marks)
 - iii. Every variable must be declared before it is used in the program (the classic C or Pascal rule). (2 marks)
 - iv. Assignment statements must end with a semicolon (`;`). (2 marks)

QUESTION THREE (20 MARKS)

- a) Using a simple illustration, describe the overview of a language processing system. (6 marks)
- b) Discuss the TWO main buffering techniques employed in a compiler. (4 marks)
- c) Illustrate the LR parsing algorithm as used in compiler construction. 4 marks)
- d) Draw a parse tree for the following expressions in compiler construction. (6 marks)
 - i. **A: =B+C+A**
 - ii. **A: =B*(A+C)**

QUESTION FOUR (20 MARKS)

- a) Distinguish the between the TWO main phases of compilation. (4 marks)
- b) Discuss FOUR application areas of the compiler in computer science field. (8 marks)
- c) Illustrate FOUR advantages of LR parsing. (4 marks)
- d) Describe FOUR error-recovery actions that can be taken in a Lexical analyzer. (4 marks)

QUESTION FIVE (20 MARKS)

- a) Contrast between lexical analyzer and a parser. (4 marks)
- b) Explain THREE conventions of transition diagrams. (6 marks)
- c) State FIVE qualities that are important for a good compiler. (5 marks)
- d) Use the Three Address Code (3AC or TAC) method to evaluate the following expression; (5 marks)

$$z = x - 2 * y$$