*(University of Choice)*

# MASINDE MULIRO UNIVERSITY OF

# SCIENCE AND TECHNOLOGY

# (MMUST)

## MAIN CAMPUS

## UNIVERSITY EXAMINATIONS

## MAIN EXAM

## 2022/2023 ACADEMIC YEAR

## THIRD YEAR SECOND SEMESTER EXAMINATION

## FOR THE DEGREE OF BACHELORS OF SCIENCE IN

## (COMPUTER SCIENCE)

**COURSE CODE:** BCS 324

**COURSE TITLE:** COMPILER DESIGN AND CONSTRUCTION

**DATE: 12/04/2023**        **TIME: 08:00-10:00AM**

---

**INSTRUCTIONS TO CANDIDATES:**
**ANSWER QUESTIONS ONE AND ANY OTHER TWO.**

MMUST observes ZERO tolerance to examination cheating

Paper Consists of 3 Printed Pages. Please Turn Over   .

## QUESTION ONE                                                    [30 MARKS]

a.  Why study compilers and its design issues?                    [2 marks]

b.  Differentiate between compiler and interpreter.               [2 marks]

c.  Explain the analysis-synthesis model of compilation           [4 marks]

d.  Explain using a diagram the compilation of a machine language processing system.

                                                                   [5 marks]

e.  Explain how Symbol-Table Management and Error detection and reporting tools of a compiler

    works.                                                         [3 marks]

f.  You are given a statement Totalmarks = test1 + test2 * 3 in java. Explain the output when the

    statement pass through:

    i.    Lexical analyzer                                         [3 marks]

    ii.   Syntax analyzer                                          [3 marks]

    iii.  Semantic analyzer                                        [3 marks]

g.  What are the two main properties of Intermediate code generator, write the intermediate code

    representation of **id1 = id2 + id3 * 3;**                     [5 marks]


## QUESTION TWO                                                     [20 MARKS]

a.  What are the two main components that describes a programming language?  [2 marks]

b.  Explain the Components of a context-free grammar               [4 marks]

c.  The branch statement in C language has the form: **if(expression)statement else statement**

    Using relevant notation write a production for the statement.  [3 marks]

d.  i) Explain the meaning of Parsing and ambiguity in passing     [2 marks]

    ii) Using relevant illustration explain how the statement *9-5+2* can be ambiguous  [6 marks]

e.  Explain the meaning of **Syntax-directed translation** and **annotated parse tree** as used in

    compiler design and construction.                             [3 marks]


## QUESTION THREE                                                  [20 MARKS]

a.  i. What is an Activation Record?                               [1 mark]

    ii. Explain the purpose of any THREE fields of an activation record  [6 marks]

b.  **Explain** Static allocation and Stack allocation storage allocation strategies.  [2 marks]

c. Intermediate languages Includes three kinds of intermediate representations: **Syntax trees**, **Postfix notation** and **Three-address code**. Briefly explain how each of these intermediate representations are implemented in a compiler. **[6 marks]**

d. You are in the process of design a C++ compiler, will you prefer top-down or bottom-up approach in passing. Explain. **[5 marks]**


## QUESTION FOUR [20 MARKS]

a. Explain how Lexical errors and error recovery actions are handled in a compiler.

**[4 marks]**

b. Explain 3-address codes and explain how they are implemented with suitable examples.

**[4 marks]**

c. Explain the following Issues in the design of a code generator

   i.   Input to the code generator **[3 marks]**

   ii.   Target programs **[3 marks]**

   iii.   Memory management **[3 marks]**

   iv.   Register allocation **[3 marks]**


## QUESTION FIVE [20 MARKS]

a. Explain the concept of Run-time storage management **[2 marks]**

b. Explain the principle sources of optimization, pointing out various patterns used for code optimization. **[4 marks]**

c. Explain the four primary structure-preserving transformations on basic blocks. **[4 marks]**

d. Explain various criteria for code-improving transformation **[3 marks]**

e. Explain why Subdivision of runtime memory happen whenever the compiler obtains a block of storage from the Operating System for the compiled program to run in? **[3 marks]**

f. Construct the predictive parser for the following grammar. **[4 marks]**

| |
|---|
| S→ (L)\|a |
| L→L, S\|S |