# ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

**ORGANISATION OF ISLAMIC COOPERATION (OIC)**

## Department of Computer Science and Engineering (CSE)

**SEMESTER FINAL EXAMINATION** **SUMMER SEMESTER, 2021-2022**

**DURATION: 3 HOURS** **FULL MARKS: 150**

## CSE 4801: Compiler Design

**Programmable calculators are not allowed. Do not write anything on the question paper.**

Answer **all 6 (six)** questions. Figures in the right margin indicate full marks of questions whereas corresponding CO and PO are written within parentheses.

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1. Consider the context fee grammar shown in Figure 1. 18 (CO2) (PO1)

$$G \rightarrow L$$
$$L \rightarrow E\,;L$$
$$L \rightarrow E$$
$$E \rightarrow E + T$$
$$E \rightarrow T$$
$$T \rightarrow \textbf{\textit{id}}$$
$$T \rightarrow \textbf{\textit{id}}\,(\,L\,)$$

**Figure 1:** A context-free grammar for Question 1.

a) Construct a predictive parse table for the grammar.

b) Show the parsing steps for the input text ***id(id+id);id*** using parse table generated from the answer of Question 1.a) 7 (CO2) (PO1)

2. a) What are the different storage allocation strategies for function implementation during compiler design? Discuss their pros and cons. 15 (CO4) (PO1)

b) You need to design a compiler which will support recursive call of functions. Which storage allocation strategy should you implement? Justify your answer. 10 (CO4) (PO1)

3. a) State how static checking and dynamic checking can be handled during compiler construction time. 5 (CO1) (PO1)

a) Explain implementation of different types of static checking with examples. 10 (CO1) (PO1)

b) Write down the semantic rules to assign types to the nodes representing left side of the following productions: 10 (CO5) (PO1)

$$E \rightarrow E_1 + E_2$$
$$E \rightarrow E_1 \textbf{ and } E_2$$
$$E \rightarrow E_1[E_2]$$

4. Consider the context-free grammar shown below:

$$A \rightarrow (A)$$
$$A \rightarrow a$$

**Figure 2:** A context-free grammar for Question 4.

a) Construct the set of LR(1) items and draw the respective transition diagram. 9 (CO2) (PO3)

b) Construct a CLR parse table for the grammar using the data generated by the answer of Question 4.a) 9 (CO2) (PO3)

c) Construct an LALR parse table for the grammar. 7 (CO2) (PO3)

5. a) Discuss Syntax-Directed Definitions in brief. 5 (CO3) (PO1)

b) Assume that the maximum length of the right side of the productions of a grammar is $n$. How many passes may be required at most to evaluate the inherited attributes of a syntax tree generated for an input for the grammar? Discuss in detail along with definition of inherited attributes. 10 (CO3) (PO1)

c) Provide an efficient tree traversal method to evaluate L-attributed definitions. 10 (CO3) (PO1)

6. a) With an example, discuss how the `yylval` variable can be used to build communications between lex and yacc program. 5 (CO1) (PO1)

b) Write a lex program to count and print the total number of words, numbers and characters in a text file. Text file name will be given as an argument to the program. 10 (CO1) (PO1)

c) Considering the grammar given in Figure 3, design the SDDs to construct syntax tree for a given input using bottom-up approach. 10 (CO3) (PO3)

$$E \rightarrow E+T$$
$$E \rightarrow E-T$$
$$E \rightarrow T$$
$$T \rightarrow (E)$$
$$T \rightarrow \textbf{\textit{id}}$$
$$T \rightarrow \textbf{\textit{num}}$$

**Figure 3:** A context-free grammar for Question 6.c)