

Roll Number: _____

Thapar Institute of Engineering & Technology, Patiala

Computer Science and Engineering Department

AUXILLARY EXAMINATION

Course Code: UCT 502

Course Name: Compiler Design

March 7, 2022

Monday, 5.30 PM – 7.30 PM

Time: 2 Hours, M. Marks: 50

Name of Faculty: Dr. Rupali Bhardwaj

Note: ATTEMPT ANY 5 QUESTIONS OUT OF 7 QUESTIONS.

- 1 Consider the following Context-Free Grammar

$$G = \{ \{E, T, F\}, E, \{*, -, +, /, (,), id\}, P \}$$

where P is set of productions having elements:

$$E \rightarrow E + T \mid T$$

$$T \rightarrow T * F \mid F$$

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

- a) Construct the LR(0) canonical set for the above grammar. 5
- b) Construct $SLR(1)$ parsing table for the above grammar. 3
- c) Show the actions of the $SLR(1)$ parser to recognize input string $id * id + id$ 2

- 2 Consider the regular expression $(a \mid b)^*abb$ with $\Sigma = \{a, b\}$

- a) Using Thompson's rule construct NDFA 5
- b) Using subset construction algorithm construct DFA from NDFA obtained in 2 (a). 5

- 3 Consider the following Context-Free Grammar along with Semantic actions for each production in $G = \{E, \{E, T, F\}, \{+, \times, id, (,)\}, P\}$, where P is set of productions as:

$$E \rightarrow E_1 \times T$$

$$\{E.val = E_1.val * T.val\}$$

$$E \rightarrow T$$

$$\{E.val = T.val\}$$

$$T \rightarrow T_1 + F$$

$$\{T.val = T_1.val + F.val\}$$

$$T \rightarrow F$$

$$\{T.val = F.val\}$$

$$F \rightarrow id$$

$$\{F.val = id.lexval\}$$

$$F \rightarrow (E)$$

$$\{F.val = E.val\}$$

- a) Construct LL(1) parser for the above grammar. 6
- b) Construct the annotated parse tree for expression $3 \times 4 + 5 \times 8$ 4
- 4 a) Explain the different representations of 3-address code with the help of a suitable example 5
- b) Describe each phase of compiler with suitable examples 5

- 5 Differentiate between

- i. Inherited and synthesized attributes
- ii. Top down and Bottom up parser.
- iii. L-attributed and S-attributed Grammar.
- iv. Ambiguity with example

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6 a) Explain in brief the different ways of passing the parameters to the procedure with help of some examples. 5

b) Using suitable examples, differentiate between 5

i. Various error recovery modes

ii. Dependency graph and Annotated Parse tree

7 a) Consider the following grammar representing simplified expressions: 6

$$S \rightarrow id\ O$$

$$O \rightarrow O\ Op\ |\ \epsilon$$

$$Op \rightarrow mode\ |\ scale\ |\ precision\ |\ base$$

$$mode \rightarrow real\ |\ complex$$

$$scale \rightarrow fixed\ |\ floating$$

$$precision \rightarrow single\ |\ double$$

$$base \rightarrow binary\ |\ decimal$$

Give the leftmost derivation for the input string "*foo real fixed real floating*". Describe at each derivation step the production rule used.

b) Given brief reasons (in favor or against) for each of the following statements 4

i. The size of SLR(1) table and LALR(1) table for the same grammar are identical.

ii. While parsing a sentence of a language, the behavior of LR(1) parser and LALR(1) parser are identical.