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F-Block

Roll Number: _____

Thapar Institute of Engineering and Technology, Patiala

Computer Science & Engineering Department

B.E.(COE) 7th Semester WT

October 27th, 2021

Name of Faculty: SHB, KAR, RUB, RKT, MUS

UCS802: Compiler Construction

Time: 02 Hours; MM: 45

NOTE: ATTEMPT ANY 5 QUESTIONS OUT OF 7 QUESTIONS. IT IS COMPULSORY TO MENTION, ON THE TOP OF FIRST SHEET, THE QUESTION NUMBERS YOU ARE ATTEMPTING. ONLY FIRST 5 ANSWERS WILL BE EVALUATED. ATTEMPT PARTS OF ONE QUESTION IN SEQUENCE. Assume missing data, if any.

1. a) Diagrammatically represent various phases of compiler and explain first three phases in detail with examples. 2+6
b) What does YACC stands for? 1
2. Consider the language $L = \{a^n b^m : (n + m) \text{ is even}\}$
a) Give the regular expression for the language given above. 1
b) Using the syntax tree method, draw the annotated syntax tree. Find the firstpos, lastpos and followpos. 2+3
c) Generate the DFA using syntax tree method. Minimize the DFA. 2+1
3. a) Give the First and Follow set for the given grammar. 2+2

$$S \rightarrow ACB \mid Cbb \mid Ba$$

$$A \rightarrow da \mid BC$$

$$B \rightarrow g \mid \epsilon$$

$$C \rightarrow h \mid \epsilon$$
 b) Perform left factoring for the given grammar. 2

$$S \rightarrow aSSbS \mid aSaSb \mid abb \mid b$$
 c) Consider the following grammar representing simplified expressions: 3

$$S \rightarrow \text{def id } O$$

$$O \rightarrow O Op \mid \epsilon$$

$$Op \rightarrow \text{mode} \mid \text{scale} \mid \text{precision} \mid \text{base}$$

$$\text{mode} \rightarrow \text{real} \mid \text{complex}$$

$$\text{scale} \rightarrow \text{fixed} \mid \text{floating}$$

$$\text{precision} \rightarrow \text{single} \mid \text{double}$$

$$\text{base} \rightarrow \text{binary} \mid \text{decimal}$$

Give the leftmost derivation for the input string "def foo real fixed real floating".
Describe at each derivation step the production rule used.
4. Consider the grammar given below:

$$Z \rightarrow d \mid XYZ$$

$$Y \rightarrow \epsilon \mid c$$

$$X \rightarrow Ya \mid dZ$$
 a) Generate the canonical LR(1) set of items for the grammar. 4
 b) Generate the ACTION and GOTO Table. 3
 c) Give the LALR set of items for the same. 2
5. Explain the following:
 a) L-attributed and S-attributed Grammar. 3
 b) Various error recovery modes. 4
 c) Ambiguity with example 2
6. Consider the following Context-Free Grammar

$$E \rightarrow (L) \mid a$$

$$L \rightarrow L, E \mid E$$
 a) Construct the LL (1) parsing table for this grammar. 5
 b) Check if the grammar is LL(1) or not. Give reason to justify your statement. 2

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- c) Parse the following string " $((a), a, (a, a))$ " 2
7. Consider the following Context-Free Grammar along with Semantic rules for each production in $G = \{E, \{E, T, F\}, \{+, \times, id, (,)\}, P\}$, where P is set of productions as:

| Production | Semantic Rule |
|----------------------------|-------------------------------|
| $E \rightarrow E \times T$ | $E.val = E1.val \times T.val$ |
| $E \rightarrow T$ | $E.val = T.val$ |
| $T \rightarrow T + F$ | $T.val = T1.val + F.val$ |
| $T \rightarrow F$ | $T.val = F.val$ |
| $F \rightarrow id$ | $F.val = id.lexval$ |
| $F \rightarrow (E)$ | $F.val = E.val$ |

- a) Construct SLR parsing table. 6
- b) Parse the following string " $5 \times 6 + 5 (8 + 6)$ " using Bottom-up evaluation of syntax directed translation and calculate the final value after evaluation of the string. 3