Roll No. of candidate ☐☐☐☐☐☐☐☐☐☐

9/2/ 2021

M.C.A. 3rd Semester End-Term Examination

COMPILER DESIGN

Full Marks – 70   Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer question no. 1 and any *four* from the rest.

1. Select the correct Options: (10 × 1 = 10)

   (i) Which computer program accepts the high-level language and converts it into assembly language?

      (a) Interpreter   (b) Linker

      (c) Assembler   (d) Compiler

   (ii) Parsing is categorized into how many types?

      (a) three types   (b) four types

      (c) two types   (d) five types

   (iii) Which derivation is generated by the top-down parser?

      (a) Right-most derivation in reverse

      (b) Left-most derivation in reverse

      (c) Right-most derivation

      (d) Left-most derivation

   (iv) Which parser is most powerful in the following parsers?

      (a) Operator Precedence   (b) SLR

      (c) Canonical LR   (d) LALR

   (v) In Compiler lexical analyzer is used for?

      (a) removing comments

      (b) removing whitespace

      (c) breaking the syntaxes in the set of tokens

      (d) All of the mentioned

(vi) Let L1 = {w ∈ (0,1)* | w has at least as many occurrences of (110)'s as (011)'s}.

Let L2 = {∈ {0,1}* | w has at least as many occurrences of (000)'s as (111)'s}.

Which of the following is correct?

(a) L2 is regular

(b) L1 and L2 are regular

(c) L1 is regular but not L2

(d) None of them are regular

(vii) What are the number of tokens that will be generated by the scanner for the below given statement?

x= x * (a + b)–5

(a) 7

(b) 10

(c) 11

(d) 12

(viii) If a state does not know whether it will make a shift operation or reduction for a terminal, it is ——————

(a) Reduce/Shift conflict

(b) Reduce conflict

(c) Shift/reduce conflict

(d) Shift conflict

(ix) Look at the below given statements

S1 : The front end of compiler consists of Lexical analyser, Syntax analyser and semantic analyser.

S2 : Target code generator is known as the back-end of compiler.

S3 : Code optimizer is middle end of compiler and is a optional phase in compiler. Which among these above given option is correct?

(a) Only S1 and S2 are correct

(b) Only S1 and S3 are correct

(c) Only S2 and S3 are correct

(d) None of the above are correct

(x) Match the following:

(P) Lexical analysis

(i) Leftmost derivation

(Q) Top down parsing

(ii) Type checking

(R) Semantic analysis

(iii) Regular expressions

(S) Runtime environments

(iv) Activation records

(a) P ↔ (i), Q ↔ (ii), R ↔ (iv), S ↔ (iii)

(b) P ↔ (iii), Q ↔ (i), R ↔ (ii), S ↔ (iv)

(c) P ↔ (ii), Q ↔ (iii), R ↔ (i), S ↔ (iv)

(d) P ↔ (iv), Q ↔ (i), R ↔ (ii), S ↔ (iii)

2. (a) What is a compiler? List different types of Compilers. (1+2=3)

(b) Define bootstrapping. (3)

(c) What is a Symbol table? (2)

(d) What are roles and tasks of a lexical analyzer? (3)

(e) Construct a parse tree for – (id+id) (4)

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3. (a) State the differences between top-down and bottom-up parsing. (3)

(b) What are the functions performed in synthesis phase? (3)

(c) Differentiate token, pattern, lexeme. (3)

(d) What is shift reducing parsing? What are the coflict during shist reducing parsing? (2+4=6)

4. (a) Calculate FIRST and FOLLOW for the following grammar? (4+4=8)

(i) $E \rightarrow E+T/T$

$T \rightarrow T*F/F$

$F \rightarrow (E)/id$

(ii) $S \rightarrow xABC$

$A \rightarrow a \mid bbD$

$B \rightarrow a \mid \varepsilon$

$C \rightarrow b \mid \varepsilon$

$D \rightarrow c \mid \varepsilon$

(b) Check whether the following grammar is LL(1) or not. (7)

$A \rightarrow xByAA' \mid a$

$A' \rightarrow zA \mid \varepsilon$

$B \rightarrow b$

5. (a) State the differences between Left Factoring and Left Recursion. How they can be eliminated. (2+3=5)

(b) Remove left factoring of the following Grammars: (2×2½=5)

(i) $S \rightarrow iEtS \mid iEtSeS \mid a$

(ii) $S \rightarrow bSSaaS \mid bSSaSb \mid bSb \mid a$

(c) Eliminate the left recursion for the following Grammar. (2×2½=5)

(i) $S \rightarrow a \mid \wedge \mid (T)$

$T \rightarrow T, S \mid S$

(ii) $E \rightarrow E+T \mid T$

$T \rightarrow T * F \mid F$

$F \rightarrow (E) \mid id$

6. (a) Construct the LALR parsing table for the grammar. (6)

S → L=R/R
L → *R/id
R → L

(b) Find the SLR parsing table for the given grammar and parse the sentence (a+b)*c. (3+3+3=9)

E → E+E | E*E | (E) | id.

7. (a) Define a Directed Acyclic graph. Construct a DAG and write the sequence of Instructions for the expression a+a* (b-c)+(b-c)*d. (3+4=7)

(b) Write short notes on YACC. (3)

(c) Let us consider the Grammar for arithmetic expressions. The Syntax Directed Definition associates to each non terminal a synthesized attribute called val. (5)

PRODUCTION	SEMANTIC RULE
L → En	Print (E.val)
E → E1+T	E.val: = E1.val + T.val
E → T	E.val: = T.val
T → T1 * F	T.val := T1.val * F.val
T → F	T.val := F.val
F → (E)	F.val:=E.val
F → digit	F.val:=digit.lexval

For the I/P expression (4*7+1)*2 construct an annotated parse tree according to the given syntax directed definition.

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