## **Question Paper**

Exam Date & Time: 04-Dec-2023 (02:30 PM - 05:30 PM)



## MANIPAL ACADEMY OF HIGHER EDUCATION

## FIFTH SEMESTER B.TECH. DEGREE EXAMINATIONS - NOVEMBER / DECEMBER 2023 SUBJECT: CSE 3151- COMPILER DESIGN

Marks: 50 Duration: 180 mins. Answer all the questions. 1A) Draw a single transition diagram to identify logical operators (&&,||,!), bitwise operators(&,|) and (5)relational operators (<,>,<=,>=,==,!=). Explain Panic mode error recovery technique in lexical analysis with a suitable example. (3+2 = 5 marks)1B) Explain different phases of compiler for the input (3)"S = ((p / w - x) + y]) \*5.0".1C) Write a Lex program to count identifiers in a C program. (2)For the following grammar, construct the full CLR (1) DFA, showing all items in each state. And 2A) (5)construct the CLR (1) parse table for the same.  $P \rightarrow mPnP \mid nPmP \mid \epsilon$ Consider the following grammar. 2B) (3) $S \rightarrow Term Length$ Term → integer Term → float Term → character Length → Length, id Length  $\rightarrow$  id Indicate all the handles and the corresponding reducing production rules in right-sentential form for the input string: "integer id,id" Write a BISON program to parse the following Boolean expression : (1) A And B and (2) A Or B. 2C) (2)Both "And" and "Or" logical operator has left associativity and same precedence. 3A) Construct LR(0) automata and SLR(1) parse table for the grammar given below. (5) $S \rightarrow XY \mid W$  $X \rightarrow aXb \mid \epsilon$  $Y \rightarrow cY \mid \epsilon$  $W \rightarrow aWc$ Show parsing action for "aabc\$". 3B) Considering the list of productions given below, construct an annotated parse tree for evaluating the (3) input expression "23\*4+5". Also, define the semantic rules for the productions. (Note: While deriving the semantic rules, make sure that individual digits are converted to an integer using basic mathematical rule.)

## Production

$$\begin{split} & S \rightarrow E \$ \\ & E \rightarrow E_1 + E_2 \\ & E \rightarrow E_1 * E_2 \\ & E \rightarrow (E_1) \\ & E \rightarrow I \\ & I \rightarrow I_1 \text{ digit} \\ & I \rightarrow \text{ digit} \end{split}$$

3C) 4A)

$$Z = (a+b) * ((c-d) / (a+b)) / ((c-d) / (a+b))$$

ii) Implement the created DAG using value number method.iii) Generate three address code for the created DAG.

Determine the Three Address Code for the given code segment.

Interpret the Three Address Code statements generated for the following expression using triples. (3)

$$(a+b)\times((c-d)\times(a+b))+((c-d)\times(a+b))$$

4C)

4B)

while (A < C and B > D) do

else

while A <= D

$$do A = A + B$$

5A) Illustrate the following characteristics of peephole optimization with the help of an example. (5) i) Flow-of-control optimization ii) Elimination of unreachable code iii) Algebraic simplification and reduction in strength.
5B) For the given 'C' expression (a \* a) + a \* (b \* b) + b, construct Directed Acyclic Graph (DAG), and (3) list the steps for constructing the DAG using Syntax directed definition.
5C) Generate code for the following three-address statements assuming a and b are array with elements of 4-byte values. Also compute the cost involved. x = a[i]

y = b[j]

a[i] = y

b[j] = x

-----End-----

(2)

(5)

(2)