#### MCA/4<sup>TH</sup> SEM/ MCAP 2252/2021

### COMPILER DESIGN (MCAP 2252)

**Time Allotted : 3 hrs** 

Full Marks: 70

 $10 \times 1 = 10$ 

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and <u>any 5 (five)</u> from Group B to E, taking <u>at least one</u> from each group.

Candidates are required to give answer in their own words as far as practicable.

## Group – A (Multiple Choice Type Questions)

1. Choose the correct alternative for the follo	owing:
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- (i) The optimization which avoids test at every iteration is
   (a) Loop Unrolling
   (b) Loop Jamming
   (c) Constant Folding
   (d) Loop Invariant Removal
- (ii) Shift-reduce parser uses
  (a) pointer
  (b) stack
  (c) array
  (d) queue
- (iii)  $S \rightarrow CC$ ,  $C \rightarrow c C | d$  The grammar is (a) LL(1) (b) SLR(1) but not LL(1) (c) LALR(1) but not SLR(1) (d) LR(1) but not LALR(1)
- (iv) Given an arbitrary non-deterministic finite automaton (NFA) with n states, the maximum number of states in an equivalent minimized DFA is at least
   (a) n<sup>2</sup>
   (b) 2<sup>n</sup>
   (c) 2n
   (d) n!
- (v) S -> aSa| bSb| a| b ;the language generated by the above grammar is the set of
   (a) All palindromes
  - (b) All odd length palindromes
  - (c) Strings beginning and ending with the same symbol
  - (d) All even length palindromes
- (vi) Which of the following is not an intermediate code form?
  - (a) Postfix notation (b) Syntax tree
  - (c) Three address code (d) Triple
- (vii) A program that translates the form of expressions without a change of language is called
   (a) Optimizing compiler
   (b) Decompiler
  - (a) Optimizing compiler(c) Cross compiler

(d) Rewriter

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- The phase of a compiler where an unmatched bracket can be detected is (viii) (a) Lexical Analysis
  - (c) Semantic Analysis
- (b) Syntax Analysis
- (d) Code Optimization
- (ix) Context Free grammar is accepted by (a) Turing Machine (b) Linearly bounded automaton (c) Pushdown automaton (d) Finite automaton
- (x) Conventionally, lower case English alphabets at the end of the alphabet set i.e. x, y etc. are members of
  - (a)  $V_N$  (Set of non-terminals)
  - (c) Strings of terminals

(b)  $\Sigma$  (Set of terminals or alphabet set) (d)  $(V_N U \Sigma)^*$ .

## Group - B

- 2. What is the significance of the signal 'get next token'. Explain in terms of the (a) working principle of a compiler.
  - (b) Write a LEX program that accepts a English Statement and coverts lower case words into their upper case counterparts.
  - (c) Explain the order of the phase 'Code Optimization' in terms of the steps of compilation. Give the standard views on it.

3 + 5 + 4 = 12

- 3. (a) Write a regular expression to recognize a signed real number in mantissaexponent form.
  - Write down the rules of Thompson Construction with suitable example. (b)
  - (c) Convert the following regular expression into NFA.  $0(0|1)^*1$ .

3 + 5 + 4 = 12

# **Group – C**

- Consider the following grammar: 4. (a) S $\rightarrow$ aABb, A $\rightarrow$ c|  $\varepsilon$ , B $\rightarrow$ d|  $\varepsilon$ . Create the LL(1) parsing table for this grammar. Then parse suitable strings using the table.
  - (b) Explain the FOLLOW function with suitable example.

9 + 3 = 12

- 5. In which situation there can be a S-R conflict in a LALR parser. Explain with (a) proper example.
  - Construct a LALR parsing table from the following grammar. (b)  $S \rightarrow AA, A \rightarrow aA, A \rightarrow b.$

3 + 9 = 12

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### Group – D

- 6. (a) Comment on the use of symbol table for the compiler. What information should be associated with a symbol name in the symbol table?
  - (b) Describe data structures for the symbol table and compare them.

(2+4)+6=12

- 7. (a) Explain the following terms with suitable example:(i) call by reference, (ii) call by name.
  - (b) What is a display? How does it help in accelerating the program execution?

(3+3) + (2+4) = 12

## Group – E

- 8. Explain the following terms with suitable examples (Any Three):
  - (i) Constant Folding,
  - (ii) Common Sub Expression Elimination,
  - (iii) Loop Unrolling.

 $(4 \times 3) = 12$ 

- 9. (a) What is a leader of basic block? Write and explain the algorithm used to find leaders.
  - (b) Construct a DAG for the following basic block.
    - d:=b\*c e:=a+b b:=b\*c a:=e-d

What are the legal evaluation orders and names for the values at the nodes of the created DAG?

- (i) Assuming a,b and c are live at the end of the basic block.
- (ii) Assuming only a is live at the end.

(2+3)+7=12

Department & Section	Submission Link
MCA	https://classroom.google.com/c/MzA5NzA0OTU2MDgw/a/MjI2NDA0OTQwMDM4/details