**Indian Institute of Engineering Science and Technology, Shibpur**

**B.Tech (Computer Science & Technology) 7th Semester End Semester Examination,**

**December 2021**

**Compiler Design (CS-701)**

**Full Marks: 70 Time: 1 hour 30 minutes**

**Group A**

**Answer any one from questions 1 and 2.**

1. Consider the following augmented grammar with the set of terminal symbols {a,b,c,d,e, #} and the set of non-terminal symbols {S,A,B,C} when S is the start symbol of the grammar. The production rules of the augmented grammar are:

S🡪A#

A🡪bB

B🡪cC

B🡪cCe

C🡪dA

A🡪a

1. Construct the collection of sets of LR(0) items for this grammar and draw LR(0) parsing machine. 9
2. Compute FIRST and FOLLOW for all nonterminal symbols. 2+6
3. Draw the parsing table. 10
4. Is the grammar SLR? Show the reason for your answer. 1+2

2. (a) Define left-recursive grammar. How can left-recursion be removed from a left-recursive grammar. 2+4

(b) Consider the grammar with the set of terminal symbols {a,i,e,t,b,#} and the set of nonterminal symbols {S, S’, E} when S is the start symbol of the grammar and # is the terminal symbol appended to the input string to be parsed:

S🡪iEtSS’ |a

S’🡪eS|Ɛ

E🡪b

1. Define FIRST and FOLLOW of a non-terminal symbol. 4
2. Compute FIRST and FOLLOW of all non-terminal symbols. 2+4
3. Compute and show the predictive parsing table. 8

(iv) Define LL(1) grammar. Is the grammar defined above LL(1)? 4+2

**Group B**

**Answer any two questions from question numbers 3, 4, and 5**

1. (a) Discuss the necessity of using MACRO in Assembly language programming. What are the data structures needed to design a MACRO preprocessor. Explain the MACRO preprocessor using a flowchart. 2+4+4

(b) What is the issue that motivates to design a 2-pass assembler? How can this issue be resolved if single pass assembler is designed? 2+4

(c ) What are the relative advantages and disadvantages of single pass and two pass assemblers? 4

1. (a) Define synthesized attribute and inherited attribute. Using suitable example grammar, explain Synthesized attribute and Inherited attribute for the symbols in a grammar. 5+5

(b) Define activation record? How is the display area constructed, if a block at level j is entered from a block at level i? 2+4+4

1. (a) Define the data flow properties: (i) Available expression (ii) Reaching definition. What are the conditions that need to be satisfied for (i) an expression to be available and (ii) a definition to reach at a particular point of the source program. (2+2)+(3+3)

(b) How can directed acyclic graph (DAG) be used to eliminate common sub-expression? Explain with example. 10