| Roll Number: _____ | |
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| **Thapar Institute of Engineering and Technology Patiala** | |
| **Computer Science and Engineering Department** | |
| **END Sem Test** | |
| BE COE & CSE (7th Semester) | UCS802: Compiler Construction |
| 14th December 2023, 2:00PM <br> Time: 3 Hours, Max Marks:35 | Coordinators: Dr. Shalini Batra, Dr. Sunita Garhwal |
| **Instructors: Shalini Batra, Karun Verma, Sunita Garhwal, Rupali Bhardwaj, Geeta Kasana, Shashank Singh.** | |

**Note: Attempt any 5 questions. Attempt all questions(subparts) in sequence at one place. Assume missing data, if, any, suitably.**

| Q1 | Consider the following grammar: | |
|---|---|---|
| | $$X \rightarrow YZ \mid g$$ $$Y \rightarrow gY \mid h$$ $$Z \rightarrow kZ \mid \epsilon$$ | |
| | a) Construct LR(1) items for the given grammar. | 3 |
| | b) Construct the ACTION and GOTO table from the derived set of items. | 3 |
| | c) Show a trace of parsing for string *ghk* | 1 |
| Q2 | Consider the following grammar for simple arithmetic expressions: | |
| | $$exp \rightarrow exp + term \mid exp - term \mid term$$ $$term \rightarrow term * factor \mid factor$$ $$factor \rightarrow (exp) \mid number$$ | |
| | a) Compute the attribute equations for the *val* attribute. | |
| | b) Draw the parse tree for *(34-3)*42* showing *val* attribute computation for the attribute grammar. | 2 <br> 2 |
| | c) Eliminate Left Recursion from the obtained translation scheme. | 3 |
| Q3 | Consider the following expression: | |
| | $$-(s * t) + (u + w) - (s + t + u + w)$$ | |
| | a) Represent the above expression in the form of : | |
| | i) Syntax tree   ii) Directed Acyclic Graph      iii) Quadruple     iv) Triples | 5 |
| | v) Indirect triples | |
| | b) Differentiate between L-attributed definitions and S-attribute definitions with suitable example. | 2 |
| Q4 | Consider the following pseudo code for Fibonacci series: | |
| | ``` int Fibonacci (int n) {    if (n==0 )    return 0;   else if (n==1)   return 1;   else     return ( fibonacci(n-2 ) + fibonacci( n-1 )); } void main () {     fibonacci(4);   } ``` | |
| | | 4 |

| | | |
|---|---|---|
| | a) Draw possible organisation (in stack form) for the run time environment of the above pseudo code. | |
| | b) Discuss the structure of Activation Record in brief. | 3 |
| Q5 | Consider the following C code segment:<br><br>a=1, c=2;<br>b=c*d;<br>x=c+a;<br>for (int e=x; e<5; e++)<br>{ printf("compiler design");<br><br>}<br><br>a) Name various code optimization techniques which can be applied to the code given above and write the final optimized code. | 4 |
| | b) Explain the following optimization techniques with suitable example:<br>i) Code Movement<br>ii) Strength Reduction | 3 |
| Q6 | Consider the following grammar G:<br><br>$A \rightarrow B\ C$<br>$B \rightarrow C\ A\ \|\ b$<br>$C \rightarrow AA\ \|\ a$<br><br>a) Remove the left recursion, if any. | 2 |
| | b) Compute FIRST and FOLLOW for the obtained grammar in Q6(a). | 2 |
| | c) Construct LL(1) table for the obtained grammar in Q6(a). | 3 |