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- Notes :
1. All questions carry marks as indicated.
  2. Solve Question 1 OR Questions No. 2.
  3. Solve Question 3 OR Questions No. 4.
  4. Solve Question 5 OR Questions No. 6.
  5. Solve Question 7 OR Questions No. 8.
  6. Solve Question 9 OR Questions No. 10.
  7. Solve Question 11 OR Questions No. 12.
  8. Illustrate your answers whenever necessary with the help of neat sketches.

1. a) Explain Various Phases of Compiler in detail. 6  
b) What is the role of finite automata in design of Lexical analysis? 4  
c) Explain the difference between phase and pass of compiler. 3

**OR**

2. a) What is Cross-compiler? Explain how boot-strapping is used in design of a compiler. 7  
b) Construct minimized DFA for the regular expression  $(a/b)^* (aa/bb) (a/b)^*$ . 6
3. a) Compare SLR, CLR and LALR parser. 4  
b) Consider the following grammar 9  
 $S \rightarrow AA$   
 $A \rightarrow aA$   
 $A \rightarrow b$   
and construct the LALR parsing table.

**OR**

4. a) Construct LR (1) parsing table for the following grammar. 9  
 $S \rightarrow AaAb \mid BaBb$   
 $A \rightarrow \epsilon$   
 $B \rightarrow \epsilon$   
b) Compare predictive parser with Shift-Reduce parser. 4
5. a) Translate the following assignment statement of intermediate code using array reference. 14  
 $A[I,J] = B[I,J] + C[A[K,L]] + D[I+J]$   
where A, B, C, D are array of 2x3, 4x5, 6 and 7 respectively. Assume bpw = 4.  
Draw Annotated parse tree for the same.

**OR**

6. a) Generate 3-address code for given program fragment :- 10  
 While ( $A > B$  or  $C > D$ ), do  
   If  $G < H$  then  
      $x = y + z$   
   else  $x = y - z$

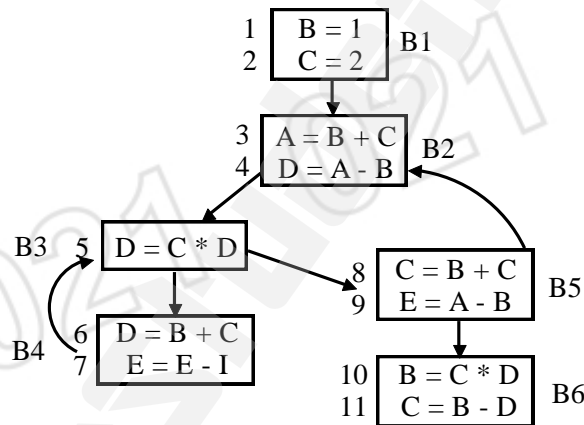
- b) What are different types of intermediate codes? Comment following statement into all intermediate code 4  
 $a = \text{SQRT}(b * b - 4 * a * c) / 2 * a$

7. a) Explain phrase level error recovery in LR parsing. 7  
 b) When error is detected in Top-down parser? How LL(1) parser recovers from error. 6

**OR**

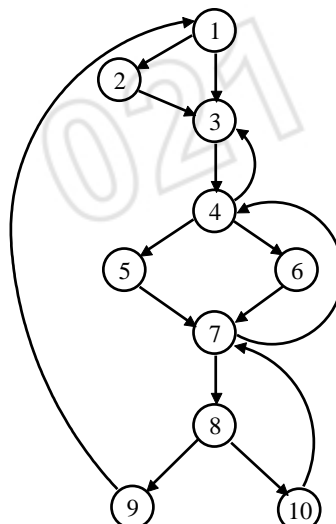
8. a) Discuss different symbol table organization in compilers. 6  
 b) Explain error recovery in predictive parsing. 7

9. Compute IN and OUT equations for following graph. 13



**OR**

10. a) What is dominators? How is it used to detect a loop? Construct dominator tree for the following graph. 6



- b) Explain the properties of code improving transformation. 3
- c) Explain loop unrolling and loop jamming. 4
11. a) What are the design issues of code generator. 4
- b) Give labelling algorithm & determine number of registers required to evaluate following instructions set 6
- $T_1 = a + b$   
 $T_2 = c + d$   
 $T_3 = e + f$   
 $T_4 = T_2 + T_3$   
 $T_5 = T_4 + T_1$
- c) Write an algorithm for heuristic ordering for evaluation order. 4
- OR**
12. a) How algebraic properties are used to reduce register requirement during code generation. 7
- b) Apply Heuristic ordering algorithm to detect optimal sequence & then generate optimal code for the sequence using 2 registers  $R_0$  and  $R_1$  for the following code : 7
- $T_1 = a + b$   
 $T_2 = c + d$   
 $T_3 = e - T_2$   
 $T_4 = T_1 - T_3$

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**High expectations are the key to everything.**

**~ Sam Walton**

