



- Notes :
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 7. Solve Question 11 OR Questions No. 12.
 8. Due credit will be given to neatness and adequate dimensions.
 9. Assume suitable data whenever necessary.

1. a) What is mean by phase and a pass of a compiler? Explain lexical analysis phase of a compiler in detail. 9

b) What are compiler writing tools. 5

OR

2. a) Explain block diagram of phases of compiler. 7

b) Write a LEX program to identify real constants in a text file. Real constants may be represented in floating point format or exponential format. 7

3. a) What is the significance of FIRST and FOLLOW in top down parsers? "A E-free grammar can be parse using LL(1) parsing table without FOLLOW set" Justify the statement. 6

b) Construct LR (0) parsing table for the grammar
 $S \rightarrow CC$
 $C \rightarrow CC \mid d$

OR

4. a) Show that the following grammar is LR(1) but not LALR.
 $S \rightarrow Aa \mid bAc \mid Bc \mid bBa$ 8

$A \rightarrow d$

$B \rightarrow d$

b) Shift-Reduce parser carries out the action within braces immediately after reducing with corresponding rule of the grammar. 5

$S \rightarrow x Wx \quad \{ \text{print "1"} \}$
 $S \rightarrow y \quad \{ \text{Print "2"} \}$
 $W \rightarrow Sz \quad \{ \text{Print "3"} \}$

What is the translation of

i) $xxyzxzx$

Show all the steps of reduction.

P.T.O

Intermediate code.

$$a = \text{SQRT } (b' * b - 4 * a * c) / 2 * a$$

- b) Give SDTS and generated three address code for the following statement
 $A[i, B[k]] = B[i+k] + A[i, k]$
 assume array A is of size 20 x 30 and
 B is of size 30, and
 bpw = 04

OR

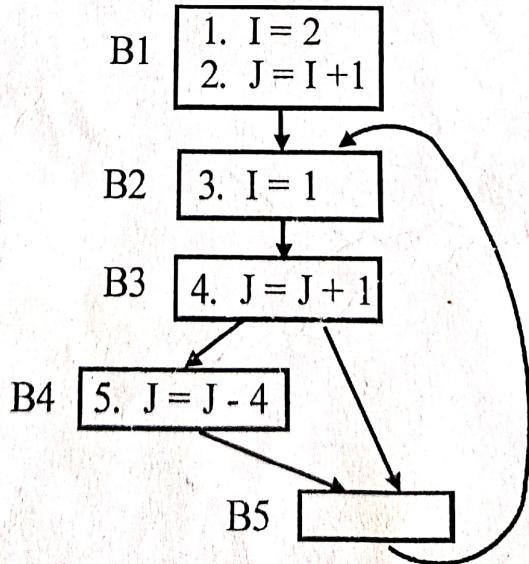
6. a) Explain the use of following functions in SDTS,
 i) gene code ii) backpatch
 iii) Merge iv) Make list
- b) Give SDTS and three address code of following program fragment
 While ($a < 10$ and $C > D$) do
 if ($a < b$) then
 $a = a + b$
 else
 $b = a + b$
7. a) How different attributes of an identifiers in block structured language is stored.
 b) Give run time storage management for call and return statement.

OR

- a) Explain phrase level error recovery in LR parsing.
 b) When error is detected in top-down parser? How LL(1) parser recovers from error.
 c) What are different optimizations performed on loops.
 d) How loops are detected in three address code.

OR

8. a) What is data flow equations? Solve data flow equations for the following flow graph.



P. Pages : 3
Time : Three Hours



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 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

$$\begin{aligned} S &\rightarrow AA \\ A &\rightarrow aA \\ A &\rightarrow b \end{aligned}$$

and construct the LALR parsing table.

OR

4. a) Construct LR (1) parsing table for the following grammar. 9

$$\begin{aligned} S &\rightarrow AaAb \mid BaBb \\ A &\rightarrow \epsilon \\ B &\rightarrow \epsilon \end{aligned}$$
- 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 :-
 While ($A > B$ or $C > D$), do
 If $G < H$ then
 $x = y + z$
 else $x = y - z$

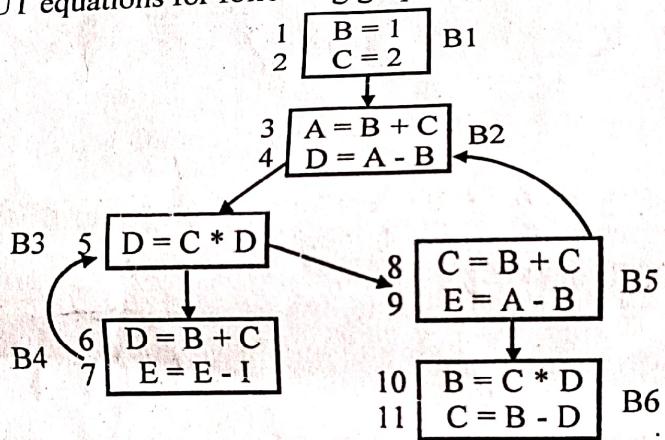
- b) What are different types of intermediate codes? Comment following statement into all intermediate code
 $a = \text{SQRT}(b * b - 4 * a * c) / 2 * a$

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

OR

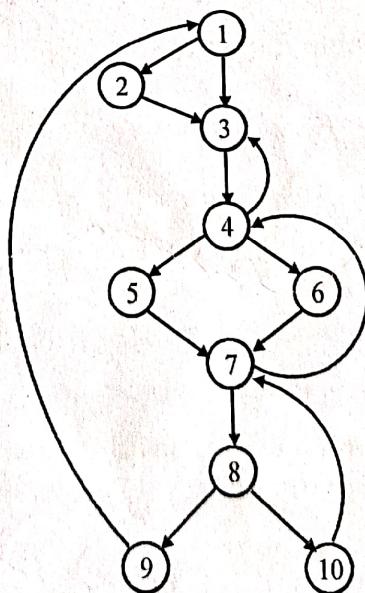
8. a) Discuss different symbol table organization in compilers.
 b) Explain error recovery in predictive parsing.

9. Compute IN and OUT equations for following graph.



OR

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



B.E.(Computer Science & Engineering) Semester Seventh (C.B.S.)
Language Processor

P. Pages : 2

Time : Three Hours



KNT/KW/16/7488

Max. Marks : 80

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 8. Due credit will be given to neatness and adequate dimensions.
 9. Assume suitable data whenever necessary.
 10. Illustrate your answers whenever necessary with the help of neat sketches.
 11. Use of non programmable calculator is permitted.

1. a) Explain different phases of compiler. 9
 b) What is boot strapping compiler and cross compiler. 4

OR

2. a) Write a LEX program that recognizes :- 9
 i) Keyword if, while, for
 ii) Identifier
 iii) Operator +|-|*|1.
 b) Why lexical analyzer reads few characters beyond the token in advance before declaring validity of token. Explain with example. 4

3. a) Generate CLR table for following grammar. State whether grammar is CLR or not. 10
 $B \rightarrow bDAe$

$$D \rightarrow Dd; | E$$

$$A \rightarrow A; E | E$$

$$E \rightarrow B | a$$

- b) What is an ambiguous and unambiguous grammar. 4

OR

4. a) Construct LL (1) parser for following grammar. Show moves made by this LL(1) parser on input "id + id * id" 8

$$E \rightarrow E + T | T$$

$$T \rightarrow T * F | F$$

$$F \rightarrow (E) | id$$

- b) Compare SLR, CLR and LALR parser. 6

5. a) Write SDTS and obtain three address code for the following statement. 9

if (P > q and r <= s)

then

$$u = u * v;$$

else

$$u = u/v;$$

Draw annotated parse tree

- b) Define:-
 i) Inherited attribute ii) Synthesized attribute

OR

6. Translate the following code into intermediate code

$$A[i, j, k] = B[i, j] + C[i + j + k]$$

where A is 3D array of size $10 \times 10 \times 10$

B is 2D array of size 10×10

C is 1D array of size 30

Bytes per word = 2

Draw annotated parse tree for the same.

7. a) What are syntactic and semantic errors? Suggest method to recover from these errors.
 b) Explain phrase level error recovery method for LR parser.

OR

8. a) Explain different data structures used for symbol table. Also compares pros and cons of each. 6

- b) What is an activation record? When this record need to be set up? Explain meaning. 7

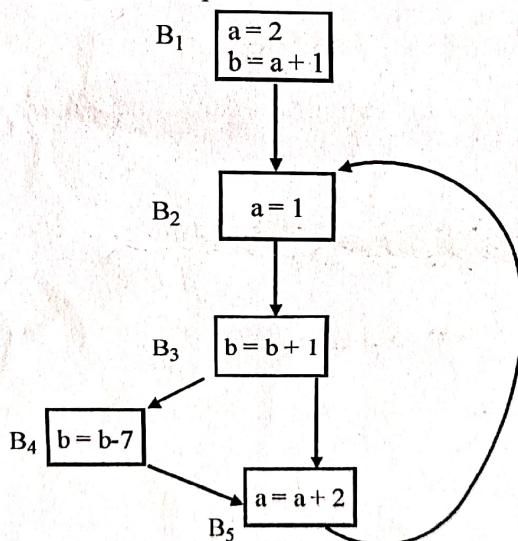
9. a) Explain loop unrolling and jamming with suitable example. 6

- b) What is reducible flow graph? Explain with example. 4

- c) Write a short note on DAG. 4

OR

10. Consider the following flow graph. Compute IN and OUT for the flow graph. 14



11. a) Generate code for the following expression using labeling algorithm
 $x = (a + b) - (e - (c + d))$ 13

OR

12. a) What are the problems in the way of good code generation. 6
 b) Explain peephole optimization techniques in detail. 7

B.E. (Computer Science & Engineering) Seventh Semester (C.B.S.)
Language Processor

P. Pages : 4
 Time : Three Hours



* 0 9 3 5 *

NRJ/KW/17/4627

Max. Marks : 80

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 7. Solve Question 11 OR Questions No. 12.

1. a) Explain various phases of compiler in brief. For the given expression, 8
 $a = b * c + d / e$
 give output of each phase of compiler including symbol table and memory representation.
- b) Explain role of Regular Expressions and Finite Automata in Lexical Analyzer. Construct 5
 Finite Automata to identify REAL numbers.

OR

2. a) Write a short note on. 5
- i) Cross compiler.
 - ii) Bootstrapping.
- Also, provide suitable example.
- b) Construct optimized DFA for the regular expression $(0+1)^*011$. Also mention algorithm 8
 for minimizing number of states of DFA.
3. a) Design LL(1) parser for the given grammar. 8
- $$S \rightarrow UVW$$
- $$U \rightarrow (S) | aSb | d$$
- $$V \rightarrow a \quad V | \epsilon$$
- $$W \rightarrow c \quad W | \epsilon$$
- Also, give parsing Actions for the input string "(dc)ac".

- b) Construct LR (0)Parser for the following grammar.

$$S \rightarrow cA | ccB$$

$$A \rightarrow cA | a$$

$$B \rightarrow ccB | b$$

check validity of string "ccccb".

OR

4. a) Determine whether given grammar is ambiguous or not.

$$S \rightarrow iSeS \mid s \mid a$$

If yes, remove ambiguity and rewrite.

- b) Determine whether given grammar is LR(1) or not.

$$S \rightarrow aIJh$$

$$I \rightarrow IbSe \mid c$$

$$J \rightarrow KLKr \mid \epsilon$$

$$K \rightarrow d \mid \epsilon$$

$$L \rightarrow p \mid \epsilon$$

5. a) List out various ways to represent Three Address code.

Write the given expression in the form of 3-Addr. Code and also represent the same with Listed representation methods.

$$a = b * -c + b * -c$$

- b) Generate 3-Address code for the given program Fragment.

While ($A > B$ or $C < D$) do

if ($D > 20$ and not ($B < C$)) then

$$A = A + B$$

else

$$D = D - 1$$

$$X = Y + Z$$

Write the translation scheme for 'WHILE' Loop.

6

6. a) Draw Annotated Parse Tree For the given expression and also generate 3-Address code.

$$(P < Q \text{ AND } R < S) \text{ OR NOT}(T < U \text{ AND } R < Q)$$

- b) For the following array reference, construct three address code (TAC).

$$C[i, j, k] = a[b[i, j], k] + a[i, j]$$

Dimensions : $c = 10 \times 20 \times 30$

$$a, b = 10 \times 20$$

Assume , bpw = 4.

7

7. a) Explain various data structures required for implementation of symbol Table.

6

- b) Explain different error recovery techniques for predictive parsing with suitable example.

7

OR



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1. a) What is cross compiler? Explain how bootstrapping is used in design of a compiler. 7
 b) Explain the various phases of compiler. 7

OR

2. a) What is the role of finite automata in design of compiler. 7
 b) What are compiler writing tools explain in detail. 7
 3. a) Compare SLR, CLR and LALR parser. 4
 b) Construct a LR (0) parser for the following grammar. 9

$$E \rightarrow BB$$

$$B \rightarrow cb / d$$
. Check validity of string "CCbb".

OR

4. a) What is meant by ambiguity of grammar? Check the given grammar is ambiguous or not. 7

$$S \rightarrow iCts / iCtSeS$$

$$C \rightarrow b$$

$$S \rightarrow a$$

 b) Define. 6
 i) Inherited attribute. ii) Synthesized attribute.
 5. Give 3-address code for given program fragment while ($A > B$) or ($C > b$), do 13
 if $G < H$ then

$$x = y + z$$

 else

$$x = y - z.$$

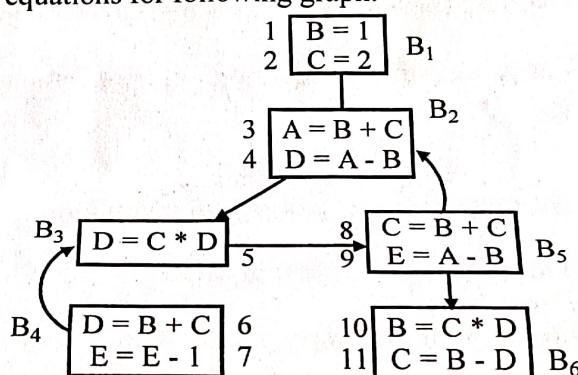
OR

6. a) Explain the use of following functions in SDTS. 6
 i) Merge. ii) Gen code.
 iii) Make list.

- b) Write SDTS and obtain 3-address code for
 if ($a < b$) then
 $a = a + b$
 else
 $b = a + b$
7. a) Explain activation record for procedure call.
 b) Discuss error recovery in YACC.

OR

8. a) Discuss different symbol table organisation in compilers.
 b) Explain error recovery in LR passing.
9. Compute In and OUT equations for following graph.



OR

10. a) What is reducible flow graph explain with example.
 b) Explain about
 a) loop unrolling. b) Loop Jamming.
11. a) Write a short note on DAG.
 b) Generate code for expressing using labelling algorithms.
 $x = (a + b) - (e - (c + d))$.

OR

12. a) Explain peephole optimization techniques in detail.
 b) Explain the need of Heuristic code generation of algorithm and perform the same on constructor DAG.
 $X = (a + b) - (e - (c * d))$.

B.E. (Computer Science & Engineering) Seventh Semester (C.B.S.)
Language Processor

P. Pages : 3

Time : Three Hours



NIR/KW/18/3572

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1. a) Explain various phases of compiler in brief. For the given expression, 8
 $a = b * c + d / e$

- b) What is Cross Compiler? Explain bootstrapping. 5

OR

2. a) What are compiler writing tools. 6

- b) Construct minimized DFA for the regular expression $a^*(aa + bb)^* b$. 7

3. a) Design LL (1) Parser for the given grammar. 8

$$S \rightarrow UVW$$

$$V \rightarrow aV / \epsilon$$

$$U \rightarrow (S) / aSb / d$$

$$W \rightarrow cW / \epsilon$$

Also, given Parsing Actions for the input string “(dc) ac”.

- b) What is an ambiguous and unambiguous grammar. 3

- c) Compare SLR, CLR and LALR Parser. 3

OR

4. a) State whether grammar is CLR, LALR or not 10

$$B \rightarrow bDAe$$

$$D \rightarrow Dd; / E$$

$$A \rightarrow A; E / E$$

$$E \rightarrow B / a$$

- b) What is the significance of FIRST and FOLLOW in top down Parsers. 4

P.T.O

5. a) What are different types of intermediate codes? Comment following statement into all intermediate code.

$a = \text{SQRT}(b * b - 4 * a * c) / 2 * a$

- b) Translate following statement into intermediate code using SDTS :

Switch ($x + y$)

{

Case 2 : $a = a + 1$; break;

Case 3 : $a = b - 1$; break;

Case 4 : switch (y)

{

Case 0 : $c = 0$; break;

Case 1 : $c = 1$; break;

}

Case 5 : $a = c - 1$; break;

Default : $a = 0$;

}

9

OR

6. Translate the following assignment statement of intermediate code using array reference.
 $A[I, J] = B[I, J] + C[A[K, L]] + D[I, J]$

13

Where A, B, C, D are array of 2×3 , 4×5 , 6 and 7 respectively. Assume bpw = 4.
 Also draw Annotated Parse tree for the same.

7. a) How different attributes of identifiers is stored in block structured language.

7

- b) Give run time storage management for call and return statement.

6

OR

8. 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

9. Write short note on :

14

i) Common sub expression elimination.

ii) Loop Jamming

L

iii) Loop Unrolling

iv) Reducible Flow Graph

v) DAG

vi) Dead Code Elimination.

OR

B.E. (Computer Science & Engineering) Seventh Semester (C.B.S.)
Language Processor

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* 0 2 5 7 *

NRT/KS/19/3572

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1. a) What do you mean by phase & pass of a compiler? Explain lexical analysis phase of a compiler in detail. 7
- b) What are compiler writing tools? Explain each in detail. 6
2. a) Explain various phases of a compiler in detail for the given expression $a = b * c + d / e$ give output for each phase of compiler including symbol table and memory representation. 8
- b) Explain & write LEX program that recognizes:
 i) Keyword if, while, far ii) Identifier
 iii) Operator + | - | * | 1 5
3. a) Generate CLR table for following grammar. State whether grammar is CLR or not. 10
 $B \rightarrow bDAe$
 $D \rightarrow Dd ; | E$
 $A \rightarrow A ; E | E$
 $E \rightarrow B | a$
- b) What is an ambiguous and unambiguous grammar. 4
4. a) Construct LL(1) parser for following grammar. Show moves made by this LL(1) parser on input "id + id * id" 8
 $E \rightarrow E + T | T$
 $T \rightarrow T * F | F$
 $F \rightarrow (E) | id$
- b) Compare SLR, CLR and LALR parser. 6
5. a) Write SDTS & obtain three address code for the following statement.
 if($p > q$ and $r \leq s$)
 then
 $\mu = \mu * v ;$
 else
 $\mu = \mu / v ;$
 Draw annotated parse tree. 9

- b) Define :
 i) Inherited attribute
 ii) Synthesized attribute
6. Translate following code into intermediate code
 $A[i, j, k] = B[i, j] + C[i + j + k]$
 where A is 3D array of size $10 * 10 * 10$
 B is 2D array of size $10 * 10$
 C is 1D array of size 30 bytes per word = 2
 Draw annotated parse tree for the same.
7. a) What are syntactic & semantic errors of suggest method to recover from these errors. 6
 b) Explain phrase level error recovery method for LR parser. 7
8. a) Explain different data structure used for symbol table. Also compare pros & cons of each. 6
 b) What is an activation record ? When this record need to be an set up? Explain meaning. 7
9. a) Explain loop unrolling & jamming with suitable example. 6
 b) What is reducible flow graph ? Explain with example. 4
 c) Write short note on DAG. 4
10. Consider following flow graph. Compute IN & OUT for flow graph. 14
-
- ```

graph TD
 B1["B1
a = 2
b = a + 1"] --> B2["B2
a = 1"]
 B2 --> B3["B3
b = b + 1"]
 B3 --> B4["B4
b = b + 7"]
 B4 --> B5["B5
a = a + 2"]
 B5 --> B2

```
11. Generate code for following expression using labeling algorithm  
 $x = (a + b) - (e - (c + d))$  13
12. a) What are the problems in the way of good code generation. 6  
 b) Explain peephole optimization techniques in detain. 7

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  8. Due credit will be given to neatness and adequate dimensions.
  9. Assume suitable data whenever necessary.
  10. Illustrate your answers whenever necessary with the help of neat sketches.
  11. Use of non programmable calculator is permitted.

1. a) What is cross compiler? Explain bootstrapping compiler. 6  
 b) Describe different phase of compiler with suitable. 7

**OR**

2. a) Construct DFA for following regular expression  $a^* (aa/bb)^* b$ . 5  
 b) What is meant by ambiguity of grammar? Check the given grammar is ambiguous or not. 4

$$S \rightarrow iCts / iCtSeS$$

$$C \rightarrow b$$

$$S \rightarrow a$$

- c) State the difference between a pass and phase. 4

3. a) Compare SLR, CLR and LALR parser. 4  
 b) Construct LR(1) parsing table for the following grammar. 9

$$S \rightarrow xAy | xBy | xAz$$

$$A \rightarrow q | qS$$

$$B \rightarrow q$$

**OR**

4. a) Explain recursive descent parser in details.  
 b) Construct LL (1) parsing table for the following grammar.

$$S \rightarrow Aa Ab | Ba Bb$$

$$A \rightarrow \epsilon$$

$$B \rightarrow \epsilon$$

5. Translate following statement into inter – medium code  
 $A[I, J, K] := B[I, J] + C[I + J + K]$   
 where    A is 3 – D array of size  $10 \times 10 \times 10$   
 B is 2 – D array of size  $10 \times 10$

P.T.O

C is 1 - D array of size 30

bpw = 2

Draw annotated parse tree for the same.

**OR**

6. Write SDTS for the following code : Write TAC and annotated tree diagram

14

```
{
 while (B > D and A < C) do
 if (A > Z) then
 C = C+1;
 else
 while (A < D) do
 A = A +2;
```

7. a) Explain the error recovery in LR parsing.

6

- b) Explain the symbol table management for block structured language.

7

**OR**

8. a) Explain the error recovery in LL parsing.

6

- b) What are the various attributes that should be stored in symbol table and discuss various data structures for implementation of symbol table.

7

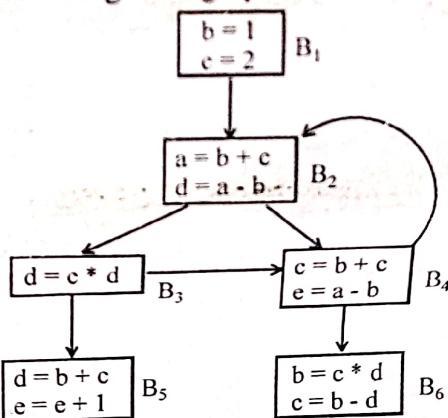
9. a) Write short note on:

13

- 1) Common subexpression elimination
- 2) Dominator node
- 3) Loop Jamming
- 4) Loop Unrolling
- 5) Reducible flow graph.

**OR**

10. Compute IN and OUT for following flow graph.



- a) Write an algorithm for heuristic ordering for evaluation order.

5

- b) Generate the code for following expression using simple code generation algorithm  
 $x = (a + b) - ((c + d) - e)$ .

9

**OR**

12. a) Explain the algorithm for Register allocation & assignment using suitable example.

7

- b) Write short notes on:

7

- 1) Problems in code generation.

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