

KATHMANDU UNIVERSITY  
End Semester Examination  
August, 2018

Level : B.Sc.

Year : III

Course : COMP 409

Semester : II

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date AUG 19 2018

SECTION "A"

[20 Q × 0.5 = 10 marks]

Tick (✓) the correct answer(s) or fill in the blanks with most appropriate word/phrase.

1. During compilation which of the following phase require the most specialized technique?  
[A] Semantic Analysis [B] Analysis  
[C] Lexical Analysis [D] Synthesis
2. Which of the following translates a predicate containing relational and Boolean operators into commands to search a database for records?  
[A] Query Interpreters [B] Silicon Compiler  
[C] Test Formatters [D] Linear Analysis
3. A major advantage of \_\_\_\_\_ is that it can utilize the best-known pattern-matching algorithms.  
[A] Lexical Analyzer Generator [B] Semantic Analysis  
[C] Syntax Analyzer [D] Code Optimizer
4. The number of tokens in the following C statement is  
printf("a=%d, &a=%x",a,&a);  
[A] 3 [B] 26 [C] 21 [D] 10
5. What a compiler can check?  
[A] Logical Error [B] Syntax Error  
[C] Both Logical and Syntax Error [D] Not Logical and Syntax Error
6. Given the language  $L = \{ ab, aa, baa \}$ , which of the following strings are in  $L^*$ ?  
1) abaabaaabaa  
2) aaaabaaaa  
3) baaaaabaaaab  
4) baaaaabaa  
[A] 1, 2 and 3 [B] 2, 3 and 4 [C] 1, 2 and 4 [D] 1, 3 and 4
7. The regular expression have all strings of 0's and 1's with no two consecutive 0's is  
[A]  $(0+1)$  [B]  $(0+1)^*$  [C]  $(0+\epsilon)(1+10)^*$  [D]  $(0+1)^*011$
8. Consider the grammas shown below:  
 $S \rightarrow AA$   
 $A \rightarrow aA \mid b$   
The grammar is  
[A] LL(1) [B] SLR(1) but not LL(1)  
[C] LR(1) but not LALR(1) [D] LALR(1) but not SLR(1)

9. Consider the grammar  
 $S \rightarrow (S) \mid a$   
 Let the number of states in SLR(1), LR(1) and LALR(1) parsers for the grammar be  $n_1$ ,  $n_2$ ,  $n_3$  respectively. The following relationship holds true  
 [A]  $n_1 < n_2 < n_3$       [B]  $n_1 = n_3 < n_2$       [C]  $n_1 = n_2 = n_3$       [D]  $n_1 \geq n_3 \geq n_2$

10. Consider the grammar with non-terminals  $N = \{ S, C, S1 \}$ , terminals  $T = \{ a, b, i, t, e \}$ , with  $S$  as the start symbol, and the following set of rules:

$S \rightarrow iCtSS1 \mid a$

$S1 \rightarrow eS \mid \epsilon$

$C \rightarrow b$

The grammar is NOT LL(1) because:

[A] It is left recursive

[B] It is right recursive

[C] It is ambiguous

[D] It is not context-free

11. A bottom up parser generates

[A] Rightmost derivation in reverse

[B] Rightmost derivation

[C] Leftmost derivation

[D] Leftmost derivation in reverse

12. Which of the following statement is false?

[A] LALR is more powerful than SLR

[B] An ambiguous grammar can never be LR(k) for any k

[C] An ambiguous grammar has same leftmost and rightmost derivation

[D] An LL(1) parser is a top-down parser

Consider the following grammar

$S \rightarrow AS'$

$S' \rightarrow +AS' \mid \epsilon$

$A \rightarrow BT'$

$A' \rightarrow *BA' \mid \epsilon$

$B \rightarrow (S) \mid id$

Question (13 and 14) are based on the given grammar

13. FIRST(S) is:

[A]  $\{+, \epsilon\}$

[B]  $\{+, ), \$\}$

[C]  $\{*, \epsilon\}$

[D]  $\{(, id\}$

14. FOLLOW(A) is:

[A]  $\{+, \epsilon\}$

[B]  $\{+, ), \$\}$

[C]  $\{*, \epsilon\}$

[D]  $\{(, id\}$

15. Consider the translation scheme as shown below

$S \rightarrow TR$

$R \rightarrow +T \{ \text{print}('+' ); \} R \mid \epsilon$

$T \rightarrow \text{num} \{ \text{print}(\text{num.val}); \}$

Here num is a token that represents an integer and num.val represents the corresponding integer value. For an input '6+3+2', this translation scheme will print

[A] 6+3+2

[B] 63+2+

[C] 632++

[D] ++ 632

16. Consider the following translation scheme

$S \rightarrow ER$

$R \rightarrow^* E\{\text{print}\{\text{"*"}\}; R \mid \epsilon$

$E \rightarrow F + E\{\text{print}\{\text{"+"}\};\} \mid F$

$F \rightarrow (S) \mid \text{id}\{\text{print}(\text{id.value});\}$

Here id is a token that represents an integer and id.value represents the corresponding integer value. For an input '2\*3+4', this translation scheme prints

[A] 2\*3+4

[B] 2\*+34

[C] 23\*4+

[D] 234+\*

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17. The identification of common sub-expression and replacement of run-time computations by compile-time computations is

[A] Constant Folding

[B] Loop Optimization

[C] Local Optimization

[D] Data flow analysis

18. The method which merges the bodies of two loops is

[A] Loop Rolling

[B] Constant folding

[C] Loop Jamming

[D] Algebraic Simplification

19. Optimization of the program that works within a single basic block is called

[A] Global optimization

[B] Loop un-controlling

[C] Loop controlling

[D] Local optimization

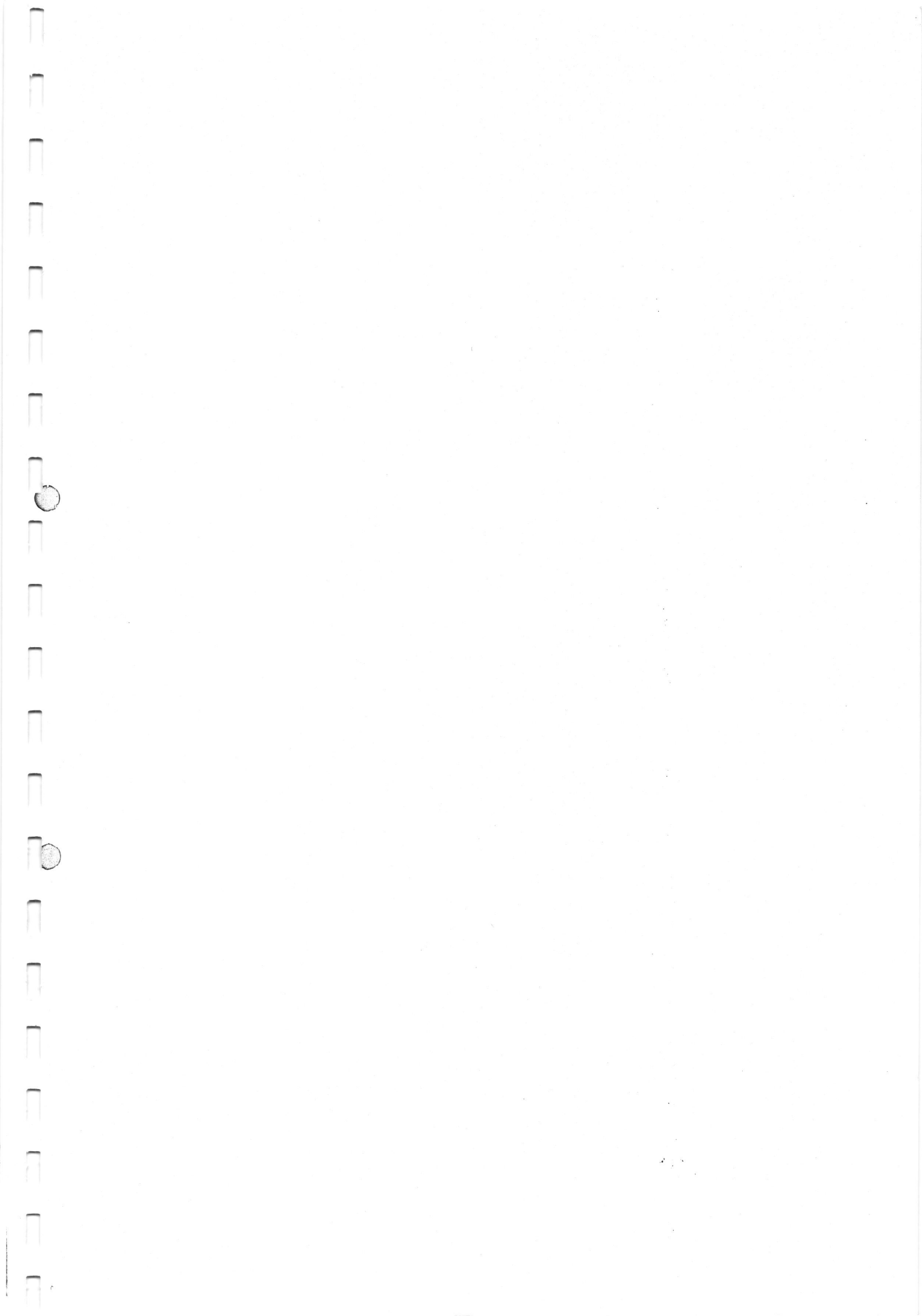
20. The optimization technique which is typically applied on loops is

[A] Removal of invariant computation

[B] Peephole optimization

[C] Constant folding

[D] All of above



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SECTION "B"

[6Q. × 4 = 24 marks]

Attempt *ANY SIX* questions.

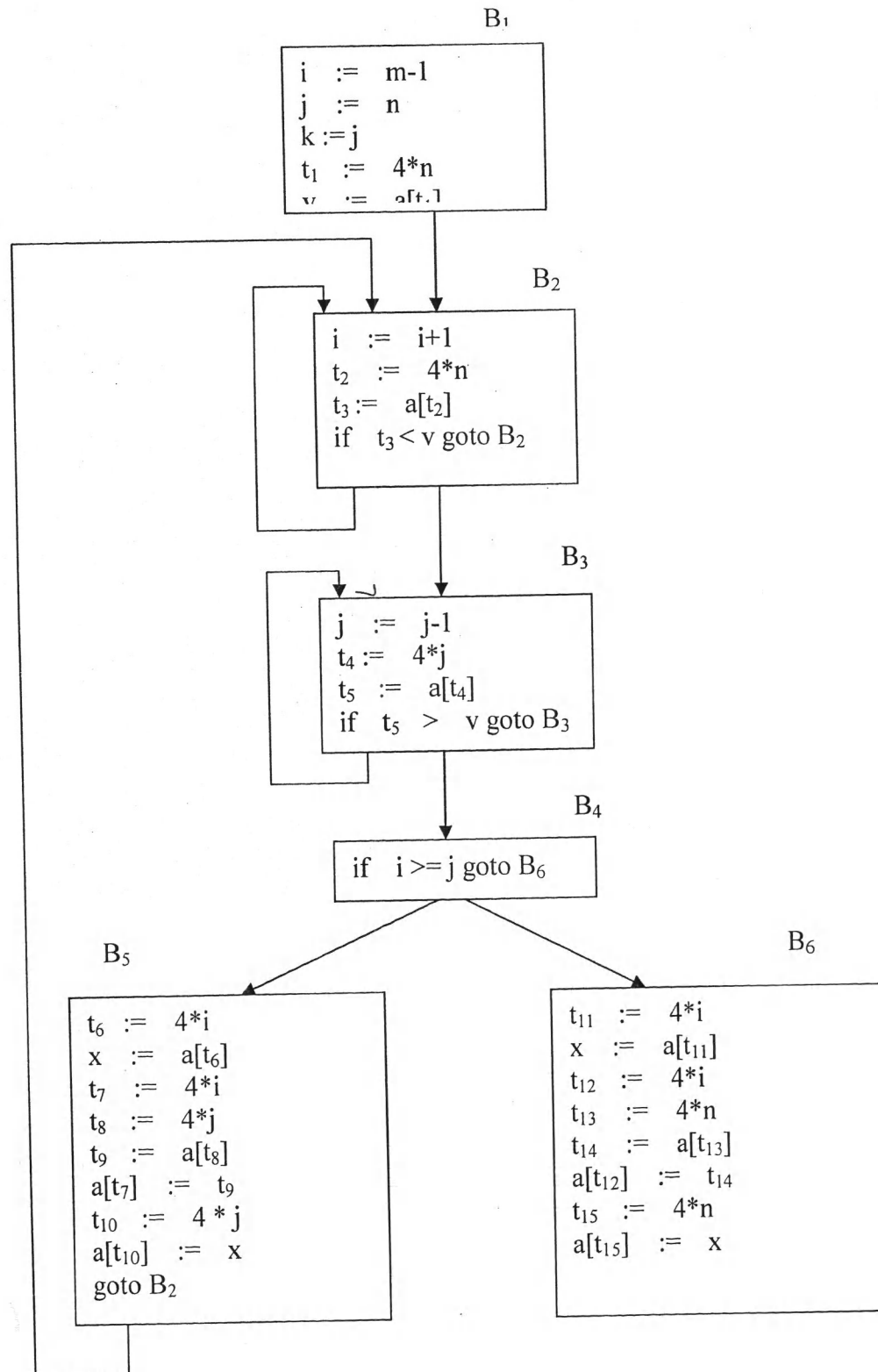
1. Draw the block diagram of compiler? Explain different steps in analysis phase.
2. Construct nondeterministic finite automata for the regular expression  $(a | b)^*abb(a | b)^*$  and convert it into DFA. Show the sequence of moves for processing the input string ababbab.
3. Define annotated parse tree. Given a syntax-directed definition of a simple desk calculator.

Production	Semantic Rules
$L \rightarrow E n$	Print (E.val)
$E \rightarrow E_1 + T$	$E.val := E_1.val + T.val$
$E \rightarrow T$	$E.val := T.val$
$T \rightarrow T_1 * F$	$T.val := T_1.val \times F.val$
$T \rightarrow F$	$T.val := F.val$
$F \rightarrow (E)$	$F.val := E.val$
$F \rightarrow \text{digit}$	$F.val := \text{digit.lexval}$

For the input expression  $(4*7+1)*2$ , construct an annotated parse tree.

4. Differentiate between recursive decent parsing and non recursive predictive parsing.
5. What is type checking? Write the type expression for the following types:
  - a) Function whose domains are functions from two characters and whose range is a pointer of integer.
  - b) An array of pointers to real where the array index ranges from 1 to 50.

6. Consider the following flow graph



- Show the local common sub expression elimination for block B<sub>5</sub>
- Eliminate the common sub expression from block B<sub>5</sub> and B<sub>6</sub>
- Eliminate the dead code from the graph with explanation if any

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7. Write short notes on
- |                       |                                   |
|-----------------------|-----------------------------------|
| a. Three-address code | b. Equivalence of type expression |
| c. Activation tree    | d. Dead code elimination          |

SECTION "C"  
[2 Q × 8 = 16 marks]

Attempt *ANY TWO* questions.

8. Consider the grammar

$S \rightarrow AA$

$A \rightarrow bA$

$B \rightarrow c$

- a. Describe the language that the grammar defines.  
b. Is the grammar ambiguous? Justify your answer.  
c. Construct a Canonical LR(1) and LALR(1) parse table for the grammar.

9. Construct the LL(1) parsing table for the following grammar

$E \rightarrow TE'$

$E' \rightarrow +TE' \mid \epsilon$

$T \rightarrow FT'$

$T' \rightarrow *FT' \mid \epsilon$

$F \rightarrow (E) \mid id$

Also trace for the input string  $id+id*id$  showing input and stack content.

10. Consider the following grammar and give the syntax directed definition to construct parse tree. For the input expression  $7*2+5*4$ , construct an annotated parse tree along with dependency graph according to your syntax directed definition.

$E \rightarrow TE'$

$E' \rightarrow +TE'$

$E' \rightarrow \epsilon$

$T \rightarrow FT'$

$T' \rightarrow *FT'$

$T' \rightarrow \epsilon$

$F \rightarrow digit$

