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B.Tech DEGREE EXAMINATION, MAY 2024

Fifth Semester

18CSC362J - COMPILER DESIGN

(For the candidates admitted during the academic year 2018-2019 to 2021-2022)

Note:

i. **Part - A** should be answered in OMR sheet within first 40 minutes and OMR sheet should be handed over to hall invigilator at the end of 40th minute.
ii. **Part - B** and **Part - C** should be answered in answer booklet.

Time: 3 Hours **Max. Marks: 100**

PART - A (20 × 1 = 20 Marks) — Answer **all** Questions

		Marks	BL	CO
1.	The lastpos of (n=ab) is (A) if lastpos(c1) else lastpos(c2) nullable (c1) U laptops(c2) (B) if lastpos(c1) else lastpos(c1) nullable (c2) U laptops(c2) (C) if firstpos(c1) else lastpos(c2) nullable (c1) U laptops(c2) (D) if lastpos(c1) else lastpos(c1) nullable (c1) U firstops(c2)	1	2	1
2.	Identify the false statement? (A) High level language programs can be translated to different intermediate representations. (B) Context free grammars are used to specify both lexical and syntax rules (C) Arguments to a function can be passed using the program stack. (D) Type checking is done before parsing	1	1	1
3.	Which type of error is returned by the compiler for the below given statement? printf("Compiler Design");$ (A) Syntax error (B) Lexical error (C) Semantic error (D) Segmentation fault	1	1	1
4.	How many tokens will be generated by the scanner for the following statement ? x = x - (a / b) + 5; (A) 10 (B) 11 (C) 7 (D) 12	1	2	1
5.	A CFG is ambiguous if and only if (A) It has more than one rightmost derivations (B) It has more than one leftmost derivations (C) No parse tree can be generated for the CFG (D) It has more than one rightmost or leftmost derivations	1	1	2
6.	Which one of the following is a top-down parser? (A) Recursive descent parser (B) Operator precedence parser. (C) An LR(k) parser. (D) An LALR(k) parser	1	1	2
7.	Among the following options, which one rightly identifies the FIRST(B) for the grammar G? G: S--> aAbB | bAaB | episilon A--> S B-->S (A) {a, b} (B) {a, b, $} (C) {a, b, episilon} (D) {S}	1	3	2

8. What will the FOLLOW(H) be in the given productions? 1 3 2

$S \rightarrow F \mid H$
$F \rightarrow p \mid c$
$H \rightarrow d \mid c$

(A) {p, c}
(B) {p, c, d}
(C) {c, d}
(D) {$}

9. Reduce-reduce conflict occurs _____. 1 1 3

(A) If a state does not know whether it will make a reduction operation using the production rule i or j for a terminal
(B) If a state does not know whether it will make a shift operation using the production rule i or j for a terminal.
(C) If a state does not know whether it will make a shift or reduction operation using the production rule i or j for a terminal.
(D) When there are no production rules to reduce

10. Which one from the following is false? 1 1 3

(A) LALR parser is Bottom - Up parser
(B) A parsing algorithm which performs a left to right scanning and a right most deviation is RL (1)
(C) In LL(1), the 1 indicates that there is a one - symbol look - ahead.
(D) LR parser is Bottom - Up parser

11. Which parsing table will have minimal entries? 1 1 3

(A) SLR
(B) CLR
(C) LALR
(D) Both SLR and LALR

12. Which of the following grammar rules violate the requirements of an operator grammar? 1 1 3

(i) A -> BC
(ii) A ->BpC
(iii) A -> ε
(iv) A ->BqCr

(A) (i) and (iv) only
(B) (iii) and (iv) only
(C) (i) and (iii) only
(D) (ii) and (iii) only

13. Substitution of values for names (whose values are constants) is done in_____ 1 1 4

(A) Strength reduction
(B) Loop optimization
(C) Local optimization
(D) Constant folding

14. The graph that shows basic blocks and their successor relationship is called _____ 1 1 4

(A) Flow graph
(B) DAG
(C) Control graph
(D) Hamiltonian graph

15. Determining incompatable types occurs in _____ phase 1 1 4

(A) syntax
(B) semantic
(C) intermediate code
(D) runtime

16. x * 2 can be replaced by x << 1 is an example of_____ 1 1 4

(A) Strength reduction
(B) Simplification of algebraic expressions
(C) Code generation
(D) constant folding

17. Which one of the following is FALSE? 1 1 6

(A) Available expression analysis can be used for common sub expression elimination

(B) A basic block is a sequence of instructions where control enters the sequence a the beginning and exits at the end.

(C) Live variable analysis can be used for dead code elimination.

(D) X=4*5=>x=20 is an example of common sub expression elimination

18. If an activation of procedure 'A' calls procedure 'B' then which one holds TRUE? 1 1 5

(A) Activation of B must end before the activation of A can end.

(B) Activation of A must end before the activation of B can end.

(C) Activation of A must end before the activation of B can start

(D) Activation of B must start after the activation of A can end.

19. Which of the following tasks is managed by a runtime stack? 1 1 5

(A) Garbage collection

(B) Variable scope

(C) Static data and functions

(D) Procedure calls and returns

20. A variable is called an _____ variable if its value is altered within the loop by a loop-invariant value. 1 1 6

(A) Invariant

(B) induction

(C) strength

(D) loop

PART - B (5 × 4 = 20 Marks) **Marks BL CO**

Answer **any 5** Questions

21. Elucidate the role of two types of pointers in input buffering scheme. How do they help in token recognition? 4 1 1

22. Construct a Deterministic Finite State Automata (DFA) that accepts strings that start and end with a over the input {a, b, c} 4 1 1

23. Consider the following grammar 4 3 2
S-->(L) | a
L-->L , S | S
Construct leftmost derivation and parse tree for (a,(a,a))

24. Show that CFG: 4 4 3
$M \rightarrow R + R/R + c/R$
$R \rightarrow c$ has reduce- reduce conflict.

25. Find leading and trailing for all the non-terminals from the following grammar 4 1 3
A→B |ApqA
B →qB|q

26. Design a DAG and syntax tree for the expression (a+b)+((a+b)*(c+d). 4 4 4

27. Brief the backpatching rules for the Boolean expression "E-->E1 and E2". 4 2 5

PART - C (5 × 12 = 60 Marks) **Marks BL CO**

Answer **all** Questions

28. (a) Using Direct Method convert the following RE a(a+b)*ab into DFA. 12 2 1

(OR)

(b) Explain all the phases of the compiler in detail. Assume a, b, and c of type float and give the conversion of "a=a+b*c*2".

29. (a) Construct a Non-Recursive predictive parsing table for the given grammar and find the moves made by a predictive parser on input string ((a)ba). 12 4 5

S →(L) |a
L → SL'
L' →bSL'|ε

(OR)

(b) Sona was asked to frame the English sentences
(i) "The student is asked to learn" from the given grammar
(ii) "The student is asked to learn Compiler design" from the given grammar

S-->Noun_Phrase Verb_Phrase
Noun_Phrase-->Pronoun | Noun | Determiner Nominal
Nominal-->Noun Nominal | Noun
Verb_Phrase-->Verb | Verb Noun_Phrase | Verb_Phrase | Verb Noun_Phrase Preposition_Phrase
Verb_Phrase-->Verb Preposition_phrase | Verb Verb_phrase Preposition_Phrase Verb
Preposition_Phrase--> Preposition| Preposition Noun_Phrase
Determiner-->a | an | the
[words like 'the', 'an', 'a' are determiners and Nominal includes words like that adds context to the noun like " English speaker", " Enjoyable day", etc].
All the words in the given sentences ((i) and (ii)) are terminals and they are derived from their respective parts of speech in English. Check whether she will successfully derive these two sentences using parse trees.

30. (a) Construct operator precedence parsing table for the following grammar 12 3 3

X →Ma
X →bMc
X →dc
X →bMa
M →d

(OR)

(b) Construct SLR parsing table for the following grammar:
S--> L =R| R
L-->* R| id
R--> L

31. (a) Consider the following: 12 1 4

x1=x2=-1;
y1=y2=1;
x3=3;
y3=-1
m12 = (y2 – y1)/(x2 – x1);
m23 = (y3 – y2)/(x3 – x2);
Interpret the instruction and generate three Address code and DAG for the above given expressions.

(OR)

(b) Give the semantic rules for the control flow statement with necessary diagrams and explanation.

32. (a) Explain the various transformations that can happen in peep hole optimizations with example for each transformation. 12 1 6

(OR)

(b) Perform all possible optimization on the given code and explain the same.

```
t0=2
t1=a
t2=12
t3=t1+t2
t4=m[t3]
t5=t0*t4
t6=-16
t7=r+t6
t8=m[t7]
t9=m[t8]
t10=t9-t5
t11=4
t12=t+t11
m[t12]=t10
```

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