$S \rightarrow Tc \mid AR$
$T \rightarrow aTb \mid \varepsilon$
$S \rightarrow cS \mid \varepsilon$
$R \rightarrow bRc \mid X \mid Y$
$X \rightarrow Xb \mid b$
$Y \rightarrow Yc \mid c$
$A \rightarrow Aa \mid \varepsilon$

28. a. Use the following grammar and check whether the word $id_1 * id_2$ is accepted or not?   10   3   3   2
$E \rightarrow E + T \mid T$
$T \rightarrow T * F \mid F$
$F \rightarrow (E) \mid id$

(OR)

b. Construct the operator precedence parsing table for the following grammar and check whether the input string $id * id = id$ is successfully parsed or not.   10   3   3   2
$S \rightarrow L = R$
$S \rightarrow R$
$L \rightarrow *R$
$L \rightarrow id$
$R \rightarrow L$

29. a. Create the code in target language for the following statements   10   3   4   3
(i) $t = a - b$ (ii) $u = a - c$ (iii) $v = t + c$ (iv) $a = d$ (v) $d = u + v$

(OR)

b. Generate the three address code for the statement $a + b * c + d$ 10   3   4   3
(i) quadruple   (ii) triple   (iii) indirect triple   (iv) syntax tree

30. a.i. Build DAG for the following code segment.   5   3   5   4
$a = b + c$
$b = a - d$
$c = b + c$
$d = a - d$

ii. Eliminate the redundancy in the following code.   5   3   5   4

```
int add_ten (int x)
{
  int  y, z;
  y = 10;
  z = x + y;
  return z;
}
```

(OR)

b. Elaborate the concept of dataflow analysis. Analyze about when gen is used and where kill is used. Describe with suitable example.   10   4   6   4

* * * * *

Reg. No. ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

B.Tech. DEGREE EXAMINATION, NOVEMBER 2022
Sixth Semester

18CSC304J – COMPILER DESIGN
(For the candidates admitted from the academic year 2018-2019 to 2019-2020)

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** should be answered in answer booklet.

Time: 2½ Hours   Max. Marks: 75

PART – A (25 × 1 = 25 Marks)
Answer **ALL** Questions

Marks   BL   CO   PO

1. In the compiler, the function of intermediate code generation is done by   1   1   2   1
   (A) Lexical analysis   (B) Syntax analysis
   (C) IM code generation   (D) Code generation

2. Which tool is used for grouping of characters in tokens in the compiler?   1   2   2   1
   (A) Parser   (B) Code optimizer
   (C) Code generator   (D) Scanner

3. What is linker?   1   1   2   1
   (A) It is always used before program execution   (B) It is used to create load module
   (C) It links the binary library files with code   (D) It is connected with parser

4. Keywords are recognized in the compiler during _____.   1   1   2   1
   (A) The code generation   (B) The data flow analysis
   (C) The lexical analysis of the program   (D) The program parsing

5. Maximum number of states of a DFA converted from an NFA with n states is   1   2   2   2
   (A) n (B) n^2
   (C) 2^n (D) $2n^2$

6. Identify the LL(1) grammar   1   2   3   2
   (A) $S \rightarrow iEES \mid iEtSE$ (B) $A \rightarrow B \mid c, B \rightarrow ab, C \rightarrow ad$
   (C) $A \rightarrow B \mid c, B \rightarrow ab \mid Ad \mid \varepsilon,$ (D) $A \rightarrow B \mid c, B \rightarrow ab \mid \varepsilon, c \rightarrow d$
   $c \rightarrow d$

7. Which one of the following is not an error-recovery strategy?   1   1   3   1
   (A) Panic mode   (B) Phrase level recovery
   (C) Error production   (D) Phrase recognition

8. YAAC is a computer program for _____ operating system.   1   1   3   1
   (A) Windows   (B) DoS
   (C) Unix   (D) Open suse

9. The variable which produces ε is called as _____. `1 1 3 1`
   - (A) Empty variable
   - (B) Nullable variable
   - (C) Terminal
   - (D) Non terminal

10. The process of restarting the deviation of a production using different derivative of same non-terminal due to unmatched input string is known as `1 1 3 2`
    - (A) Bottom-up parsing
    - (B) Derivation
    - (C) Backtracking
    - (D) Top-down parsing

11. Which of the following parser is a top-down parser? `1 1 3 2`
    - (A) LALR
    - (B) LR
    - (C) Operator precedence
    - (D) Recursive descent

12. An LR parser can detect a syntactic error as soon as `1 1 3 2`
    - (A) The parsing starts
    - (B) During left to right scan of input
    - (C) During right to left scan of input
    - (D) Parsing ends

13. If a state does not know whether it will make a shift operation or reduction for a terminal is called _____. `1 2 3 2`
    - (A) Shift/reduce conflict
    - (B) Reduce/shift conflict
    - (C) Shift conflict
    - (D) Reduce conflict

14. When β is empty $(A \rightarrow \beta.a)$ the reduction of $A \rightarrow a$ is done by _____. `1 2 3 2`
    - (A) If next symbol is a terminal
    - (B) Only if the next input symbol is a
    - (C) Only if the next symbol is A
    - (D) Only if the next input symbol is ' '

15. The construction of the canonical sets and LR is done by `1 1 3 2`
    - (A) Combining LALR items with same lookahead
    - (B) Combining LR(0) items
    - (C) Combining LR(1) items with same ending
    - (D) Combining LR(0) items with same ending

16. Code generator uses function to determine the states of available registers and the location of name values. `1 1 4 2`
    - (A) setReg
    - (B) cinReg
    - (C) pfReg
    - (D) getReg

17. Which of the following is not a form of intermediate representation? `1 1 4 2`
    - (A) Abstract syntax tree
    - (B) 3-address code
    - (C) DAG
    - (D) Reverse polish notation

18. How many descriptions are used to track the registers while generating the code `1 1 4 2`
    - (A) 2
    - (B) 3
    - (C) 4
    - (D) 5

19. In directed acyclic graph, leaf nodes not represent? `1 1 4 2`
    - (A) Identifiers
    - (B) Names
    - (C) Constants
    - (D) Expressions

20. Convert the following expression $2*3+4$ into postfix. The answer is _____. `1 2 4 2`
    - (A) $234+*$
    - (B) $23*4+$
    - (C) $*23+4$
    - (D) $*+234$

21. Which compiler runs on one machine and generates code for multiple machines? `1 1 5 2`
    - (A) Multipass compiler
    - (B) Cross compiler
    - (C) Optimizing compiler
    - (D) One pass compiler

22. A fragment of code that resides in the loop and computes the same value each iteration is? `1 1 5 4`
    - (A) Induction analysis
    - (B) Strength reduction
    - (C) Loop-invariant code
    - (D) Code analysis

23. Substitution of values for names whose values are constant, is done is `1 1 5 4`
    - (A) Local optimization
    - (B) Loop optimization
    - (C) Global optimization
    - (D) Constant folding

24. A variable is called an _____ variable is its value is altered within the loop by-a loop invariant value. `1 1 5 2`
    - (A) Invariant
    - (B) Induction
    - (C) Strength
    - (D) Loop

25. Dead code plays no role in any program operation and therefore `1 2 5 2`
    - (A) It can be eliminated
    - (B) It need not be eliminated
    - (C) It can be replaced
    - (D) It can be rearranged

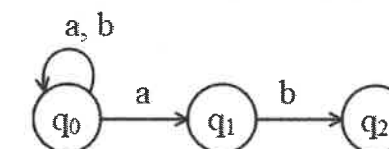**PART – B (5 × 10 = 50 Marks)** `Marks BL CO PO`
Answer **ALL** Questions

26. a. Apply Thompson's method to construct an NFA for the following expression $\left(ab+aa\right)^{*}ba$. `10 3 1 11`

(OR)

   b. Convert the following NFA to DFA. Minimize the number of states if applicable. `10 3 1 1`

27. a. Construct non-recursive predictive parser table for the given grammar and find the moves made by predictive parser on the input string $((a)ba)$ `10 3 3 3`
    $$S \rightarrow (L)/a$$
    $$L \rightarrow SL'$$
    $$L' \rightarrow bSL'|\varepsilon$$

(OR)

   b. Compute first [ ] and follow ( ) for the given productions `10 3 3 2`