VIT

Vellore Institute of Technology

(Deemed to be University under section 3 of the UGC Act, 1956)

Reg. No. : 22BCG1758

Final Assessment Test(FAT) - Nov/Dec 2024

Programme	B.Tech.	Semester	Fall Semester 2024-25
Course Code	BCSE307L	Faculty Name	Prof. Suganya R
Course Title	Compiler Design	Slot	G2+TG2
		Class Nbr	CH2024250101301
Time	3 hours	Max. Marks	100

General Instructions

- Write only Register Number in the Question Paper where space is provided (right-side at the top) & do not write any other details.

Course Outcomes

CO1. Apply the skills on devising, selecting, and using tools and techniques towards compiler design

CO2. Develop language specifications using context free grammars (CFG).

CO3. Apply the ideas, the techniques, and the knowledge acquired for the purpose of developing software systems.

CO4. Constructing symbol tables and generating intermediate code.

CO5. Obtain insights on compiler optimization and code generation.

Section - I

Answer all Questions (7 × 10 Marks)

Q.No	Question	*M	CO	BL

01.	a. Provide a detailed explanation of the compilation process using the given example to demonstrate the output of each phase of compilation for the input: (6 marks)
	while (i<=num) {
	sum= sum + i * 20;
	i++;
	}
	b. Construct Non-Deterministic Finite Automata for the Regular expression R = (0|1)* (00 |11) (0|1)* (4 marks)
		10	1	2

02.	Consider the following regular expression (RE) 'R'. Convert the regular expression into Deterministic Finite Automata (DFA) using direct method. (ab|c|a)(abc|c)*(bc)* a. Construct the syntax tree with first and last positions from the augmented regular expression (2 marks) b. Calculate the follow position (4 marks) c. Construct the minimized DFA (4 marks)	10	2	3
03.	Perform predictive parsing for the following grammar. expr → expr **or** term | term term → term **and** factor | factor factor → **not** factor | **(expr)** | **true** | **false** a) Compute the FIRST and FOLLOW functions (4 marks) b) Generate the parsing table (3 marks)	10	2	3

*M - Marks

c) Show the actions of the parser for the input string: **not (true or false)** (3 marks)
Note: [All terminals are represented in bold face]

04. Consider the given grammar for arithmetic expression and answer the following — 10 3 3

S → S / T
S → T
T → R - T
T → R
R → num

a. Write down the semantic rules for evaluating the arithmetic expression (4 marks)
b. Draw the annotated parse tree for "132 / 4/ 8 -2 / 8 - 2 - 1" and print the results (3 marks)
c. Draw the dependency graph (3 marks)

05. Generate three address code for the following control statement and represent it in quadruples (4 marks), triples (3 marks) and indirect triples (3 marks) — 10 4 3

If((a==1 && a==0) || (a<b && a>c))
y= 1
else
y=0

06. Write the grammar and Syntax Directed Translation scheme (SDT) to generate three-address code for Boolean expression. — 10 4 4

((x >= y) or (a != b)) and ((c < d) or (e == f))
a. Generate the Syntax Directed Translation (SDT) production rules (3 marks)
b. Construct the parse tree (5 marks)
c. Generate the three-address code for the expression using backpatching (2 marks)

07. Evaluate the effectiveness of Automatic Parallelization and Cache Locality Optimization in handling complex, real-world applications with irregular data structures (e.g., graphs, sparse matrices) (6 marks). Analyze the challenges compilers face when automatically parallelizing such applications (4 marks) — 10 1 4

Section - II
Answer all Questions (2 × 15 Marks)

*M - Marks

Q.No	Question	*M	CO	BL
08.	Show the following grammar is SLR (1). A → Train TRAIN → DEPARTURE ARRIVAL DEPARTURE → "The train departs from" CITY "at" TIME ARRIVAL → "and arrives in" CITY "at" TIME CITY→ "Bangalore" | "Mumbai" TIME → "6:00 AM" | "2:00 PM" a. Generate the LR (0) canonical collection for the given grammar (5 marks) b. Construct the SLR (1) parsing table (5 marks) c. Parse the string below: (5 marks) The flight departs from Bangalore at 6:00 AM and arrives in Mumbai at 2:00 PM [Note: words given within double quotes to be taken as terminals e.g. "and arrives in" is a single terminal, words mentioned in uppercase are non-Terminals e.g. TIME is a non-terminal]	15	2	4
09.	a. Construct basic blocks (2.5 marks), control flow graph (2.5 marks), Dominator tree (1.5 marks) and natural loops (1.5 marks) i. a = 10 ii. b = 20 iii. t1 = a + b iv. if t1 > 15 goto L1 v. d = a / b vi. e = d + t1 vii. goto L2	15	5	4

viii. L1: d = a * b
ix. e = d - t1
x. L2: return 0

b. Construct Directed Acyclic Graph (DAG) and optimal target code for the expression (7 marks)

x=((a+b)/(b-c)) – (a+b) * (b-c)

BL-Bloom's Taxonomy Levels - (1.Remembering, 2.Understanding, 3.Applying, 4.Analysing, 5.Evaluating, 6.Creating)

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