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RAMAIAH
Institute of Technology

(Autonomous Institute, Affiliated to VTU)
(Approved by AICTE, New Delhi & Govt. of Karnataka)
Accredited by NBA & NAAC with 'A+' Grade

SEMESTER END / BACKLOG SUBJECT EXAMINATIONS – FEB / MARCH 2025

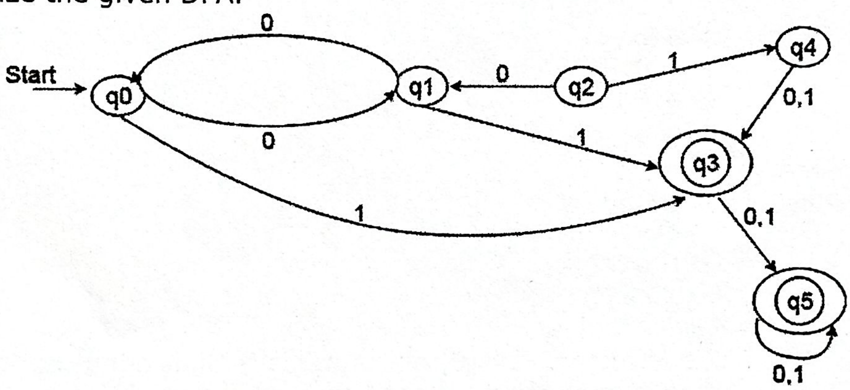
Program	:	**B.E. – CSE (Cyber Security) / CSE (Artificial Intelligence and Machine Learning)**	**Semester**	:	**V**
Course Name	:	**Automata Theory and Compiler Design**	**Max. Marks**	:	**100**
Course Code	:	**CY53 / CI53 (2021, 2022 Batch)**	**Duration**	:	**3 Hrs**

Instructions to the Candidates:

- Answer one full question from each unit.

UNIT - I

1.	a)	Construct DFA for the regular expressions given i. (a|b)*abb ii. Odd number of a's and even number of b's iii. Even number of a's and b's.	CO4	(09)
	b)	Illustrate how the language processing system translates a source program.	CO4	(05)
	c)	Demonstrate Non-Deterministic Finite Automata (NFA), differentiate with Deterministic Finite Automata (DFA).	CO1	(06)
2.	a)	Minimize the given DFA.	CO4	(09)



	b)	Describe the analysis phase of compiler with a suitable example.	CO4	(06)
	c)	Design an NFA with $\Sigma = \{0, 1\}$ which accepts the language consists of all the strings containing substring 1010.	CO1	(05)

UNIT - II

3.	a)	Illustrate Push Down Automata by constructing a PDA for the language $L = \{a^n b^{2n} \mid n \geq 1\}$.	CO1	(09)
	b)	Consider the alphabet $\Sigma=\{a,b\}$. Define a short, possibly shortest, regular expression that generates strings over Σ that contain exactly one "a" and atleast one "b" by specifying the "sentinels" input buffering technique.	CO1	(07)
	c)	Give regular expressions for the following languages: i. Strings of 0's and 1's with no consecutive 0's in it. ii. Strings that begin with b and do not contain aa.	CO4	(04)
4.	a)	Construct the Transition Diagram for accepting the given operators. i. +, -, *, /, %, ++, -- ii. relational operators	CO1	(06)

b) Identify the token, pattern and lexeme for the given code fragment. CO2 (08)

```
int main(){
  // usage of printf statement
   printf("i = %d, &i = %d", i, &i);
}
```

c) Write regular expression for CO4 (06)

i. identifying USN number of CSE(AIML)/CSE(CyberSecurity) students
ii. Email ID validation.(Hint: abc@yahoo.com)

UNIT - III

5. a) Consider the following Context Free Grammar CO3 (09)

$S \rightarrow SA \mid 0 \mid \varepsilon$
$A \rightarrow aS1 \mid a$

i. Compute the FIRST and FOLLOW sets for each non-terminal symbol.
ii. Construct the parsing Table for a predictive parser for the grammar.
iii. Is the Grammar LL (1)? Justify.

b) Explain the need of Augmentation in LR grammars and how the given grammar can be changed to an augmented grammar? CO3 (05)

c) Consider the given grammar. Eliminate left recursion from the grammars given. CO3 (06)

i. $S \rightarrow aAbA \mid aAbc \mid ScA$
$A \rightarrow aAbab \mid b$

ii. $A \rightarrow Bxy \mid x$
$B \rightarrow AD$
$C \rightarrow A \mid c$
$D \rightarrow d$

6. a) Consider the grammar: CO3 (09)

G:- $S \rightarrow aTRe$
$T \rightarrow Tbc$
$T \rightarrow b$
$R \rightarrow d$

i) Construct the LR (0) set of items by indicating the Kernel and Non-kernel items for each item set.
ii) Construct LR(0) parse table.
iii) Show the actions of a parser on input abde$

b) Consider the following grammar: CO3 (06)

$S \rightarrow SS+ \mid SS* \mid a$
Input string: aaa*a++ $

Indicate the configurations of a shift-reduce parser on the above input. In the case of a reduce action, indicate which production is used. With each action, indicate whether there is conflict or not, if exists specify the type of conflict.

c) Construct CFG for accepting the strings containing alphabets a and b, which will start with exactly one 'a' followed by any number of 'b's. CO3 (05)

UNIT- IV

7. a) Generate a postfix SDT for the given grammar and Implement the parser stack for converting binary to decimal. If a binary value '110' is given, N.val should print the final decimal equivalent value 6. CO5 (08)

$N \rightarrow D$
$D \rightarrow D_1\ B \mid B$
$B \rightarrow 0 \mid 1$

b) Design a L- Attributed Definition for converting a binary to decimal value. CO5 (07)
Consider the Production:
G:- B→N D
D→N D | ∈
N→0 | 1
Also construct the Annotated Parse tree for input string "1101"
Hint: Binary value:= 1101 should be converted to Decimal value 13.

c) Consider the rules given below CO5 (05)

Production	Semantic Rules
A→B C	A.s=B.b B.i=f(C.c,A.s)

Justify the following
i. Is this SDD L-Attributed?
ii. Is B.i valid inherited attribute definition?

8. a) Write S- Attributed Definition for computing the number of bits with value 1 in the given binary value.(Hint: If the input is a binary value 11101, from the root value N.count = 4). CO5 (06)
G:- D→D B |B
B→ 0 | 1

b) Illustrate how the parser stack is implemented for bottom up strategy with the help of the given desk calculator grammar CO4 (06)
E→E+T | T
T→T*F | F
F→num

c) Consider the following attribute grammar CO5 (08)

Production	Semantic Rule
$S \to L_1.L_2$	$S.v = L_1.v + \frac{L_2.v}{2^{L2.c}}$
S→L	S.v=L.v
$L \to L_1\ B$	$L.v=L_1.v*2+B.v$ $L.c=L_1.c+B.c$
L→B	L.v=B.v L.c=B.c
B→0	B.v=0 B.c=1
B→1	B.v=1 B.c=1

i. Draw the Annotated parse tree for the input '110.01', and show the dependency graph for the associated attributes.
ii. Describe one correct order for the evaluation of the attributes. Assume 'c' and 'v' are the synthesized attributes.
iii. What will be the value of S.v when evaluation has terminated?

UNIT – V

9. a) Discuss about the computation of type and width of array datatype for the input int a[3] by drawing an annotated parse tree. Is the grammar an attribute grammar? If not state the reason. CO4 (06)
G: D→ T id L
T→ int | float
$L \to L_1$, id | id

	b) Discuss the issues in the design of a code generator.	CO4	(06)
	c) Translate the following arithmetic expressions into DAG, Three address code and identify the value numbers for the following expressions, assuming operators associates from the left.(All the variables are integers) i. (a-b)*(c+d)+(a-b) ii. (a+b)*(c+d)-(a+b+c) iii. (a+b)+(a+b+a+b+(a+b)) iv. a[i]=b*c - b*d +b*c	CO5	(08)
10.	a) Translate the control flow statement into Three Address Code using fall-through technique. Draw Annotated Parse Tree. if(a==b && b==c || c==d) x=1;	CO5	(07)
	b) Illustrate the Translation Scheme using Backpatching for control flow statements. Discuss the three functions are used for manipulating list of jumps in the process of translation.	CO5	(07)
	c) Translate the following statement into Three Address Code. i. n=f(a[i]) ii. x=f(y+1)+2 iii. g=gcd(x-y,x)	CO5	(06)

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