GURU NANAK INSTITUTE OF TECHNOLOGY
An Autonomous Institute under MAKAUT
2022
COMPILER DESIGN
CS604A

TIME ALLOTTED: 3HR **FULL MARKS:70**

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable

GROUP – A
(Multiple Choice Type Questions)

Answer any ***ten*** from the following, choosing the correct alternative of each question: **10×1=10**

			Marks	CO No.
1.	(i)	Which of the following error will not be detected by the compiler? a) Lexical error b) Syntactic error c) Semantic error d) Logical error	1	CO1
	(ii)	From X → YZ production rule, FIRST(X) is a) FIRST(Y) b) FIRST(Y) ∪ FIRST(Z) c) FIRST(Y) ∪ FIRST(Z) if FIRST(X) contains ε else FIRST(Y) d) FIRST(Z)	1	CO3
	(iii)	lastpos of **concatenate** node with left child c1 and right child c2 is a) lastpos(c1) ∪ lastpos(c2) b) lastpos(c1) ∩ lastpos(c2) c) if (nullable(c1)) lastpos(c1) ∪ lastpos(c2) else lastpos(c2) d) if (nullable(c2)) lastpos(c1) ∪ lastpos(c2) else lastpos(c2)	1	CO2
	(iv)	A given grammar is not LL(1) if the parsing table of a grammar may contain a) any blank field b) duplicate entry of same production c) more than one production rule in a cell d) any field mentioned as error	1	CO3
	(v)	In a programming language, an identifier is permitted to be a letter followed by any number of letter followed by any number of letter or digits. If L and D denote the set of letters and digits respectively. Which of the following expressions defines an identifier? a) (L | D) + b) L. (L | D)* c) (L . D)* d) L (L . D)*	1	CO4

(vi) Which of the following software tool is a lexical analyzer generator? 1 CO2

a) Lex
b) Yacc
c) Both Lex and Yacc
d) Neither Lex nor Yacc

(vii) Which of the following statements is false? 1 CO3

a) An unambiguous grammar has same left most and right most derivation
b) An LL(1) parser is a top-down parser
c) An LR(1) parser is a bottom-up parser
d) An ambiguous grammar can never be LR(k) for any k

(viii) Which one of the following is a top-down parser? 1 CO3

a) Recursive descent parser
b) Operator precedence parser
c) An LR(k) parser
d) An LALR(k) parser

(ix) Which of the following grammar rules violate the requirements of an operator grammar? P, Q, R are non-terminals and r, s, t are terminals. 1 CO3

1. $P \rightarrow Q\ R$
2. $P \rightarrow Q\ s\ R$
3. $P \rightarrow \varepsilon$
4. $P \rightarrow Q\ t\ R\ r$

a) 1 only
b) 1 and 3 only
c) 2 and 3 only
d) 3 and 4 only

(x) Annotated Parse tree is generated in the phase of 1 CO3

a) Syntax Analysis
b) Semantic Analysis
c) Code Optimization
d) Intermediate Code Generation

(xi) Consider the given below SDT: 1 CO3

P1: $S \rightarrow MN$ {S.val= M.val + N.val}
P2: $M \rightarrow PQ$ {M.val = P.val * Q.val and Q.val =P.val}

Select the correct option:

a) Both P1 and P2 are S attributed
b) P1 is S attributed and P2 is L-attributed
c) P1 is L attributed but P2 is not L-attributed
d) Both P1 and P2 are L attributed

			Marks	CO No.
(xii)		Three Address code involves a) At least 3 addresses b) At most 3 addresses c) Exactly 3 addresses d) Ternary operator	1	CO4

GROUP – B
(Short Answer Type Questions)
(Answer any *three* of the following) **3 × 5 = 15**

			Marks	CO No.
2.		Write down the output of each phase for the expression **a: = b + c *70** [Assume a, b and c are real numbers]	5	CO1
3	a)	What is a handle?	2	CO3
	b)	Consider the Grammar E → E+E | E*E | id Find the handles of the right sentential forms of reduction for the string **id*id+id**	3	CO3
4.	a)	What is an operator grammar? Give an example.	2	CO3
	b)	Consider the following conditional statement: **if(z>4) then y= z+1 else y=10;** From the above statements how many tokens are possible and what are they?	3	CO4
5	a)	Eliminate left-recursion from the following grammar: **S → Bb | a** **B → Bc | Sd | e**	3	CO3
	b)	Consider the following grammar G: **A → aAB | aBc | aAc** Find an equivalent left-factored grammar of the above grammar.	2	CO3
6		Generate an annotated parse tree for the string "**4+5−2**" using the grammar: **E → E+T | E−T | T** **T → 0 | 1 | 2 | 3| 4 | 5| 6 | 7 | 8 | 9**	5	CO3

GROUP – C
(Long Answer Type Questions)
(Answer any *three* of the following) **3 × 15 = 45**

			Marks	CO No.
7.	a)	Construct an ε-NFA from the following regular expression: L = **(a | b)*abb**	3	CO2
	b)	Construct the equivalent DFA of that ε-NFA.	10	CO2
	c)	What are the analysis phase and synthesis phase of a compiler?	2	CO1
8.	a)	Construct a LL(1) Parsing Table for the following grammar: **S → aCDb** **C → c | ε** **D → d | ε**	10	CO3
	b)	Explain the LL(1) Parser's action by describing the moves it would make on an input **acdb$**	5	CO3

9.	a)	Compute the collection of sets of LR(0) item sets for the following grammar. $E \rightarrow E+T \mid T$ $T \rightarrow T*F \mid F$ $F \rightarrow a$	10	CO3
	b)	Construct the SLR parsing table using the SLR algorithm.	5	CO3
10.	a)	Translate the expression $a = -b * (c + d / b) - (e * f)$ into i) Quadruple ii) Triple iii) Indirect Triple iv) iv) 3-address code	8	CO2
	b)	Construct the DAG for the following basic block	5	CO2
	c)	d:= b*c e:= a+b b:= b+c a:= e-d Translate the expression **a*(b+c/d)** into syntax tree.	2	CO2
11.		Write short notes on any three of the following:	3×5=15	
	a)	Lex	5	CO2
	b)	Context Free Grammar	5	CO3
	c)	Parse Tree	5	CO3
	d)	L-attributed Syntax Directed Definition	5	CO4
	e)	Principle of sources of code optimization Unary Operators	5	CO4