

**AUTOMATA THEORY AND COMPILER DESIGN
(MCAP 2161)**

Time Allotted : 3 hrs

Full Marks : 70

Figures out of the right margin indicate full marks.

*Candidates are required to answer Group A and
any 5 (five) from Group B to E, taking at least one from each group.*

Candidates are required to give answer in their own words as far as practicable.

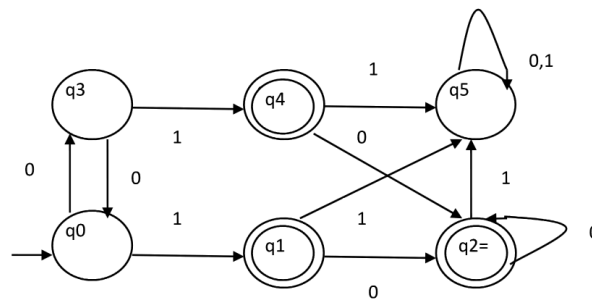
**Group - A
(Multiple Choice Type Questions)**

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) The optimization which avoids test at every iteration is
(a) Loop Unrolling (b) Loop Jamming
(c) Constant Folding (d) Loop Invariant Remova
- (ii) Which derivation is generated by the bottom-up parser?
(a) Right-most derivation in reverse (b) Left-most derivation in reverse
(c) Right-most derivation (d) Left-most derivation.
- (iii) Which of the following parser is a top-down parser?
(a) LALR parser (b) LR parser
(c) Operator precedence parser (d) Recursive descent parser
- (iv) A program that translates the form of expressions without a change of language is called
(a) Optimizing compiler (b) Decompiler
(c) Cross compiler (d) Rewriter
- (v) Shift-reduce parser uses
(a) pointer (b) stack (c) array (d) queue.
- (vi) $S \rightarrow CC, C \rightarrow c C \mid d$, The grammar is
(a) LL(1) (b) SLR(1) but not LL(1)
(c) LALR(1) but not SLR(1) (d) LR(1) but not LALR(1)
- (vii) Which of the following is not an intermediate code form?
(a) Postfix notation (b) Syntax tree
(c) Three address code (d) Triple
- (viii) $S \rightarrow aSa \mid bSb \mid a \mid b$; the language generated by the above grammar is the set of
(a) All palindromes
(b) All odd length palindromes

- (c) Strings beginning and ending with the same symbol
- (d) All even length palindromes.
- (ix) Which compiler is written in the same source programming language that it intends to compile?
 - (a) Language Rewriter
 - (b) Cross compiler
 - (c) Bootstrap compiler
 - (d) Onepass compiler.
- (x) In the study of compilers, lower case greek alphabets represent
 - (a) Set of non-terminals
 - (b) Set of terminals
 - (c) Strings of terminals
 - (d) Sentential form.

Group - B

- 2. (a) Convert the following regular expression into NFA. $0(0|1)^*1$.
[[CO4) (Apply/IOCQ)]
- (b) Write down the difference between Moore and Melay machine with suitable examples. [[CO4) (Understand/LOCQ)]
- (c) Carry out DFA Minimization of the following transition diagram.
[[CO4) (Apply/IOCQ)]



3 + 3 + 6 = 12

- 3. (a) Write a regular expression to express an identifier in C Language.
[[CO4) (Apply/IOCQ)]
- (b) State the relationship among deterministic finite automata, non deterministic finite automaton and finite automaton with epsilon transition.
[[CO4)(Remember/LOCQ)]
- (c) Explain with proper example when two states being distinguishable in regards to DFA minimization. [[CO4)(Analyze/IOCQ)]

4 + 4 + 4 = 12

Group - C

- 4. (a) Differentiate between the working principle of a compiler-compiler and a decompiler. [[CO1) (Understand/LOCQ)]
- (b) Convert the following CFG to GNF:
 $S \rightarrow AB|BC, A \rightarrow AB|a, B \rightarrow AA|CB|b, C \rightarrow a|b$ [[CO4) (Apply/IOCQ)]
- (c) Prove that $L = \{a^i b^i \mid i \geq 0\}$ is not regular. [[CO2) (Apply/IOCQ)]

3 + 5 + 4 = 12

- 5. (a) What are the steps associated to Synthesis? Mention the two models of it.
[[CO5) (Remember/LOCQ)]

- (b) Write a LEX Specification file to identify the tokens of the language C. [(CO1)(Apply/IOCQ)]
- (c) Outline the significance of the signal 'get next token' in terms of the working principle of a compiler. [(CO1)(Analyze/IOCQ)]

4 + 5 + 3 = 12

Group - D

6. (a) Consider the following grammar: $S \rightarrow aABb$, $A \rightarrow c \mid \epsilon$, $B \rightarrow d \mid \epsilon$.
Generate the LL(1) parsing table for this grammar. [(CO2) (Create/HOCQ)]
- (b) Parse a suitable string using the table created from above mentioned CFG. [(CO2) (Apply/IOCQ)]
- (c) Compute FIRST and FOLLOW for each nonterminals of the grammar:
 $E \rightarrow ME'$, $E' \rightarrow +ME' \mid \epsilon$, $M \rightarrow AM'$, $M' \rightarrow *AM' \mid \epsilon$, $A \rightarrow \text{num} \mid (E)$
[(CO1)(Apply/IOCQ)]

5 + 3 + 4 = 12

7. (a) Let a given CFG be: $S \rightarrow AA$, $A \rightarrow aA \mid b$. Detect a Shift - Reduce conflict for the corresponding LR(0) items. Suggest proper measures to get rid of it. [(CO6)(Evaluate/HOCQ)]
- (b) Explain S-Attributed definition with suitable example. [(CO2)(Understand/LOCQ)]
- (c) Differentiate between BNF and EBNF with reference to a CFG. [(CO2)(Analyze/IOCQ)]

6 + 3 + 3 = 12

Group - E

8. (a) Generate 3 address code for the following program segment:
sum = 0;
for (j = 1; j<=10;j++)
sum = sum + a[j] + b[j]; [(CO5) (Apply/IOCQ)]
- (b) Explain the lookup function to find a name in Symbol Table. [(CO5) (Understand/LOCQ)]
- (c) Differentiate between the implementation of Linear List, Binary Search Tree and Hash Table in Symbol Table regarding to suitable contexts. [(CO5)(Analyze/IOCQ)]

4 + 4 + 4 = 12

9. (a) Generate the Quadruple and Triple TAC expression for the same code. [(CO1) (Create/HOCQ)]
- (b) Outline and explain the algorithm used to find leaders. [(CO2)(Analyze/IOCQ)]
- (c) Apply the loop optimization schemes to any of your known Sorting Algorithm. [(CO2) (Apply/IOCQ)]

6 + 3 + 3 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	21.87%	60.42%	17.70%

Course Outcome (CO):

After the completion of the course students will be able to:

1. Understand the overall hierarchy of formal instructions from source code to machine code.
2. Able to apply different lemma in regards to CFG.
3. Analyze the Chomsky hierarchy of formal grammar that is suitable in abstracting the formal languages.
4. Understand the Normal Forms and Automata abstraction behind the language theory.
5. Combine the ideas of both analysis and synthesis in culminating the final low level binary instructions.
6. Able to frame a context free grammar that can combine the hierarchical features of a language.

*LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question

Department & Section	Submission Link
MCA	https://classroom.google.com/c/NDA00DIwNTE2NDYx/a/NDU30TUxNjI1NzYy/details