D 13115 (Pages : 2) Name.....

Reg. No.....

FIRST SEMESTER M.Sc. DEGREE (REGULAR/SUPPLEMENTARY) EXAMINATION, NOVEMBER 2021

(CBCSS)

Computer Science

CSS 1C 05—COMPUTER ORGANIZATION AND ARCHITECTURE

(2019 Admission onwards)

Time : Three Hours Maximum : 30 Weightage

General Instructions

1. *In cases where choices are provided, students can attend* **all** *questions in each section.*
2. *The minimum number of questions to be attended from the Section / Part shall remain the same.*
3. *The instruction if any, to attend a minimum number of questions from each sub section / sub part / sub division may be ignored.*
4. *There will be an overall ceiling for each Section / Part that is equivalent to the maximum weightage of the Section / Part.*

Section A

Answer any **four** *questions.*

Each question carries 2 weightage.

1. Draw labelled block diagram and excitation table for J K Flip Flop.
2. Draw full Adder circuit using logic gates.
3. Explain "microinstructions" with an example.
4. Explain the concept of bit pair recoding.
5. Explain ' daisy chaining'.
6. What are the different types of 8086 instructions ? Give one example each.
7. Give an example Timing Diagram based on 8085 instruction set.

(4 × 2 = 8 weightage)

Section B

Answer any **four** *questions.*
Each question carries 3 *weightage.*

8. Simplify using K-map : F (P, Q, R, S) = Σ (1, 2, 4, 7, 10, 12, 13, 15).
9. With the help of a block diagram, explain the working of Serial-In, Serial-Out shift register.
10. Illustrate how instructions are executed in a single bus architecture.
11. Summarize Booth's Algorithm.
12. Explain the working principle of cache memory. Illustrate any *one* cache mapping technique.
13. Outline the organization of a DRAM memory cell. Identify different types of DRAM.
14. Write a note on 8051 instruction set.

(4 × 3 = 12 weightage)

Section C

Answer any **two** *questions.*
Each question carries 5 *weightage.*

15. Discuss the organization of hardwired control unit. Compare it with microprogrammed control unit.
16. With the help of block diagrams explain 'Fast Adders' and 'Sequential Multipliers'.
17. Give a detailed account of programmed I/O, interrupt driven I/O and DMA.
18. Give an overview of 8085 architecture and addressing modes.

(2 × 5 = 10 weightage)

D 13114 (Pages : 2) Name.....

Reg. No.....

FIRST SEMESTER M.Sc. DEGREE (REGULAR/SUPPLEMENTARY) EXAMINATION, NOVEMBER 2021

(CBCSS)

Computer Science

CSS 1C 04—THE ART OF PROGRAMMING METHODOLOGY

(2019 Admission onwards)

Time : Three Hours Maximum : 30 Weightage

General Instructions

1. *In cases where choices are provided, students can attend* **all** *questions in each section.*
2. *The minimum number of questions to be attended from the Section / Part shall remain the same.*
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4. *There will be an overall ceiling for each Section / Part that is equivalent to the maximum weightage of the Section / Part.*

Part A

I. Short Answer Type Questions. Answer any *four* questions :

1 Distinguish between *strcpy()* and *strncpy ()* functions with example.

2 Write a function to remove the occurrences of the word "the" from a given text.

3 Differentiate between "call by value" and "call by reference".

4 Write a function to find the length of given string excluding the vowels.

5 Distinguish between continue and goto statements.

6 Illustrate with an example how array elements are accessed with pointers.

7 What is a preprocessor directive ? Give one example.

(4 × 2 = 8 weightage)

II. Short Essay *or* Problem Solving Type. Answer any *four* questions :

8 Discuss scope and lifetime of variables citing suitable examples.

9 Write a program to enter text through keyboard. Capitalize each word (change first letter of each word to capital) and display the text.

10 Illustrate with suitable examples : 'Syntax error', 'Run-time Error' and 'Logical error'

11 Explain Union with suitable example.

12 Write a program to count the occurrence of digits 0 to 9 in a list of integers from 1 to n (n is given as input). Example if $n = 25$, the output should be : Count of 0 = 2, Count of 1 = 12 and so on.

13 Compare switch and if statements.

14 Write a note on Macros.

(4 × 3 = 12 weightage)

III. Long Essay Type Questions. Answer any *two* questions :

15 Write a program to convert a decimal number into an equivalent Hexadecimal number.

16 Write a program to accept a few lines of text, convert it to uppercase and store it in a file called *uppertxt.dat.*

17 Given a 4 × 4 matrix of 0s and 1s. Assume that the first two columns represent the two inputs to a logic function and the third, the output (Truth Table). Write a function to read the matrix and identify whether the function is AND, OR, XOR or XNOR.

18 Describe operators in C and their precedence. Illustrate precedence and associativity with examples. Comment on explicit and implicit type conversions in expressions.

(2 × 5 = 10 weightage)

D 13113 **(Pages : 3)** **Name.....**

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FIRST SEMESTER M.Sc. DEGREE (REGULAR/SUPPLEMENTARY) EXAMINATION, NOVEMBER 2021

(CBCSS)

Computer Science

CSS 1C 03—THEORY OF COMPUTATION

(2019 Admission onwards)

Time : Three Hours Maximum : 30 Weightage

General Instructions

1. *In cases where choices are provided, students can attend* **all** *questions in each section.*
2. *The minimum number of questions to be attended from the Section / Part shall remain the same.*
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4. *There will be an overall ceiling for each Section / Part that is equivalent to the maximum weightage of the Section / Part.*

Section A

Answer any **four** *questions.*
Each question carries 2 *weightage.*

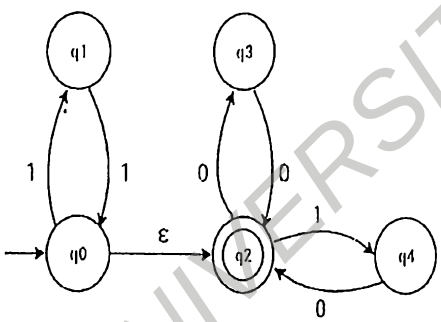
1. Define Regular language with suitable example.
2. List down the Closure properties of regular language.
3. Discuss CFG with one example.
4. State the uses of Turing decidable language classes.
5. Recite Cook's theorem.
6. Write the language generated by the regular expression $ab^*(a + b)$ and construct a DFA for the same.
7. Define Multi-tape Turing machine.

(4 × 2 = 8 weightage)

Section B

Answer any **four** *questions.*
Each question carries 3 *weightage.*

8. Construct a NFA and DFA for the language over {0, 1}, that will accept all the strings ending with 1.
9. With the help of Myhill Nerode theorem prove that L = $\{a^n b^n \mid n \geq 0\}$ is not regular.
10. State and explain CYK algorithm.
11. Illustrate how decidability problem is solved using Turing machine.
12. Explain the post correspondence problem in TOC.
13. Convert the following epsilon-NFA to NFA.



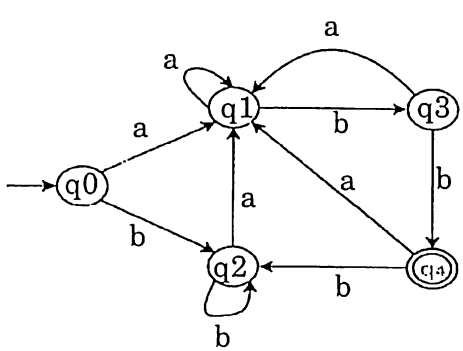
14. Discuss DCFL's and their properties.

(4 × 3 = 12 weightage)

Section C

Answer any **two** *questions.*
Each question carries 5 *weightage.*

15. Compare and contrast DFA and NFA.
16. a) Write a note on Equivalence theorem.
    b) Minimize the following DFA using equivalence theorem.



17. Explain with an example the equivalence of LBA and Context Sensitive Grammar.

18. Outline Chomsky hierarchy of grammar. Give examples for each.

(2 × 5 = 10 weightage)

D 13112 (Pages : 2) Name.....

Reg. No.....

FIRST SEMESTER M.Sc. DEGREE (REGULAR/SUPPLEMENTARY) EXAMINATION, NOVEMBER 2021

(CBCSS)

Computer Science

CSS 1C 02—ADVANCED DATA STRUCTURES

(2019 Admission onwards)

Time : Three Hours Maximum : 30 Weightage

General Instructions

1. *In cases where choices are provided, students can attend* **all** *questions in each section.*
2. *The minimum number of questions to be attended from the Section / Part shall remain the same.*
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Section A

Answer any **four** *questions.*
Each question carries 2 weightage.

1. Define the terms "data structures" and "abstract data type".
2. Compare recursive and non-recursive functions.
3. Compare doubly linked list with singly linked list.
4. What is a Treap ?
5. Explain "Extended Binary Tree".
6. Explain "Rehashing".
7. What is a Deap ?

(4 × 2 = 8 weightage)

Section B

Answer any **four** *questions.*
Each question carries 3 *weightage.*

8. Explain time complexity. Demonstrate the importance of time complexity with examples.

9. Explain the organization and advantage of deterministic skip lists.

10. Give the structure and advantage of array based circular queue. Write functions to insert and delete elements for an array based circular queue.

11. Demonstrate with an example, the steps in the deletion of a node from a Red-black tree. .

12. Explain any one graph traversal algorithm.

13. Write a note on Hash tables and Hash functions.

14. Write short notes on : (i) Binomial queues ; and (ii) Splay trees.

(4 × 3 = 12 weightage)

Section C

Answer any **two** *questions.*
Each question carries 5 *weightage.*

15. Explain the characteristics, advantages and drawbacks of recursion. Write recursive functions for the following :

    (i) To reverse a singly linked list.

    (ii) To print the n terms of the series defined by

    $F(0) = 1, F(1) = 1, F(i) = F(i-1) + F(i-2)$.

16. Explain the properties of Binary Search tree. Write and explain algorithms/functions for the insertion of a new data into a BST and for the deletion of an existing data from a BST.

17. Explain the concepts in open addressing. Illustrate with example linear and quadratic probing.

18. Explain the properties of Min-Max heaps. Give examples. Demonstrate the steps in constructing a Min Heap. Highlight any *one* application of Min-Max heaps.

(2 × 5 = 10 weightage)

D 13111 (Pages : 3) Name.....

Reg. No.....

FIRST SEMESTER M.Sc. DEGREE (REGULAR/SUPPLEMENTARY) EXAMINATION, NOVEMBER 2021

(CBCSS)

Computer Science

CSS 1C 01—DISCRETE MATHEMATICAL STRUCTURES

(2019 Admission onwards)

Time : Three Hours Maximum : 30 Weightage

General Instructions

1. *In cases where choices are provided, students can attend* **all** *questions in each section.*
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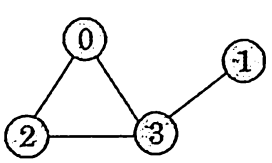
Section A

Answer any **four** *questions.*
Each question carries 2 weightage.

1. Define Equal sets. Find whether $A = \{x : x \in N, 4 \leq x \leq 8\}$ and B = {4, 5, 6, 7,8} are equal sets ?
2. Let $f(x) = 6x^2 + 8x - 10$ and $g(x) = 2x + 5$ then find $f \circ g$ and $g \circ f$.
3. State Duality Principle. Using it prove $p \cup ((q \cup p) \cap \bar{q}) = 1$.
4. Write a note on monoids with the help of an example.
5. Identify whether the following graph is bipartite or not. Give reasons to your answer.



Turn over

6. State Principle of Inclusion and Exclusion.

7. Draw Hasse diagram for $(D_{12}, /)$ [Here, D_{12} means set of positive integers divisors of 12].

(4 × 2 = 8 weightage)

Section B

Answer any **four** *questions.*

Each question carries 3 *weightage.*

8. Discuss Propositional Logic. Find whether the given preposition is a tautology or contradiction.

$S:((P \wedge Q) \rightarrow R) \rightarrow ((P \wedge Q) \rightarrow (Q \rightarrow R))$.

9. Let the relation $\{R(a,b) \mid |a+1| = |b+1|\}$ is on the set of integers Z. Find the equivalence classes for R.

10. Using an example differentiate complemented and distributive lattices and its properties.

11. State and proof Lagrange's Theorem.

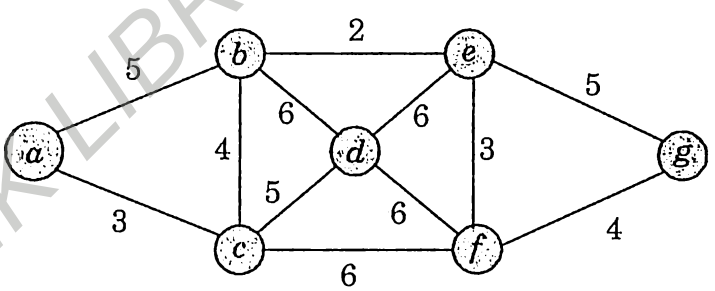
12. Explain Eulerian path and circuit. Sketch an Eulerian path and circuit for the given set of numbers {0, 1, 2, 3, 4}.

13. Write a note on Predicate logic. Write the predicate logic for the following :

    (a) Everyone loves Jerry.

    (b) If anyone cheats, everyone suffers.

14. Find how many distinct minimum spanning trees are possible for the following graph using Kruskal's algorithm :



(4 × 3 = 12 weightage)

Section C

Answer any **two** *questions.*
Each question carries 5 *weightage.*

15. Explain :

    (a) Well Formed Formulas and its associated rules .

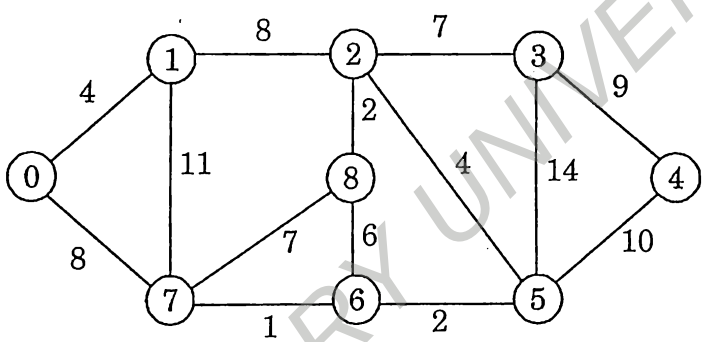
    (b) Free and Bound variables with examples.

16. (a) Given $h(x) = (1 + 2x) / (7 + x)$ then find $h^{-1}(x)$.

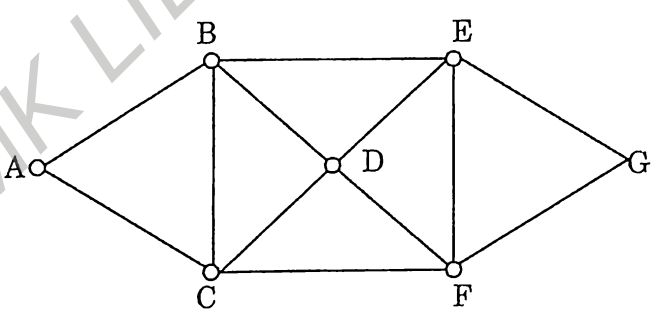
    (b) Let say S is the set of all people in world and R is the relation defined on a set S such that $(a, b) \in R$, where a and b are people, if a is taller than b then find whether (S,R) is a poset or not ?

17. Demonstrate homomorphism, Ring and Fields with examples.

18. (a) Find the shortest path from 0 to 4 for the given weighted graph using Dijkstra's algorithm.



(b) Does the following graph has a Hamiltonian path and circuit ? If so find one.



(2 × 5 = 10 weightage)

D 12898 (Pages : 2) Name.....

Reg. No.....

FIRST SEMESTER M.Sc. DEGREE (SUPPLEMENTARY) EXAMINATION NOVEMBER 2021

(CUCSS)

Computer Science

CSS 1C 05—COMPUTER ORGANIZATION AND ARCHITECTURE

(2014 to 2018 Admissions)

Time : Three Hours Maximum : 36 Weightage

Section A

Answer **all** *questions.*

Each question carries 1 *weightage.*

1. Differentiate exclusive OR gate and OR gate.
2. What is DeMorgan's theorem ?
3. How do you execute an instruction sequence ?
4. Name some of the common registers and its functions.
5. Define an array multiplier. What is its use ?
6. What are the functions of Arithmetic and Logic unit ?
7. What do you mean by programmed I/O ?
8. What is a Software interrupt ?
9. Define an IO Processor.
10. What is an 8051 microcontroller ?
11. What are the various operations performed by 8085 to execute a program ?
12. What are Sequential circuits ? Draw the block diagram of a clocked synchronous sequential circuit.

(12 × 1 = 12 weightage)

Section B

Answer any **six** *questions.*
Each question carries 2 weightages.

13. Give a short account on Boolean algebra.
14. Briefly explain half adder along with its representation.
15. Name the different types of Addressing modes.
16. Explain double bus structure with a diagram.
17. Explain in brief addition and subtraction with signed magnitude data.
18. Describe the characteristics of main memory.
19. Write a note on vectored interrupts.
20. What are the different functional units of 8085 microprocessor ?
21. Draw the Timing diagram of CALL instruction and briefly explain.

(6 × 2 = 12 weightage)

Section C

Answer any **three** *questions.*
Each question carries 4 weightage.

22. Define a combinational circuit. What are the procedures to draw the same ?
23. What are the steps followed during an instruction cycle ? Explain.
24. Briefly explain the steps carried out in a memory read and write cycle. Depict in a diagram also.
25. What is the use of Memory Management System ? Briefly explain its requirements.
26. Explain the architecture of 8051 microcontroller with a neat diagram.
27. What are the two parts in floating point representation ? Explain with an example.

(3 × 4 = 12 weightage)

FIRST SEMESTER M.Sc. DEGREE (SUPPLEMENTARY) EXAMINATION NOVEMBER 2021

(CUCSS)

Computer Science

CSS 1C 04—THE ART OF PROGRAMMING METHODOLOGY

(2014 to 2018 Admissions)

Time : Three Hours Maximum : 36 Weightage

Section A

Answer **all** *questions.*

Each question carries 1 *weightage.*

1. Differentiate between flow chart and algorithm.
2. What are run-time errors in a program ?
3. What do you mean by structured programming ?
4. How will define a local variable in C ? Explain with an example.
5. Differentiate between ++a and a++ operation in C.
6. What are control structures in C ? Give suitable example.
7. Explain the difference between *break and continue* statement in C.
8. What are two dimensional arrays in C ?
9. Distinguish between structure and union.
10. Explain the differences between auto and extern variables in C.
11. What is a pointer variable? How can it be initialized ?
12. What is a file ?

(12 × 1 = 12 weightage)

Section B

Answer any **six** *questions.*

Each question carries 2 *weightage.*

13. Draw the flow chart to find the largest element in a given list of elements.
14. What are the different types of constants in C ? Explain.

15. Explain how a string variable is declared and initialized in C.
16. Explain the differences between call-by-value and call-by-reference with example.
17. Write a C program to compute the factorial of a number using recursion.
18. What is array of pointer ? How it is initialized ?
19. Explain the Explain the differences between *while* and *do., while* construct in C.
20. Explain **fscanf()** with example.
21. What is macro and how it differs from a C variable.

(6 × 2 = 12 weightage)

Section C

Answer any **three** *questions.*
Each question carries 4 *weightage.*

22. Write note on relational and logical operators in C with examples.
23. Write a C program to generate N prime numbers.
24. Write a C program to print the binary equivalent of a decimal number using a user-defined function called **ToBin()**.
25. Give a detailed account on different dynamic allocation functions available in C.
26. Explain the syntax and function of different string handing functions in C.
27. Write a C program to read name and marks of *n* number of students from user and store them in a file.

(3 × 4 = 12 weightage)

D 12894 (Pages : 2) Name.....

Reg. No.....

FIRST SEMESTER M.Sc. DEGREE (SUPPLEMENTARY) EXAMINATION NOVEMBER 2021

(CUCSS)

Computer Science

CSS 1C 01—DISCRETE MATHEMATICAL STRUCTURE

(2014 to 2018 Admissions)

Time : Three Hours Maximum : 36 Weightage

Section A

Answer **all** *questions.*
Each question carries 1 *weightage.*

1. What is Tautology ? Give example.
2. Write the negation of the following statement $\exists x \in R\ x > 3 \Rightarrow x^2 > 9$.
3. What are the different types of functions ?
4. Define equivalence relation.
5. Define Lattice.
6. State partial ordering on S.
7. Define ring with an example.
8. State LaGrange's theorem.
9. Define isomorphic graphs.
10. Give an example for a graph which is Eulerian, but not Hamiltonian.
11. Write the negation of the statement 'All people are beautiful'.
12. Construct the truth table for proposition.

(12 × 1 = 12 weightage)

Section B

Answer any **six** *questions.*
Each question carries 2 *weightage.*

13. Explain free and bound variables with examples.
14. Write the truth table for conditional and biconditional statements.
15. Define a Poset and a Hasse diagram of a Poset.
16. Give a relation which is both a partial ordering relation and an equivalence relation on a set.
17. Discuss basic properties of Algebrain systems defined by Lattices.
18. What is Surjective and Injective function types. Give examples.
19. Write short notes on Semigroup and Monoid.
20. Draw a complete bipartite graph of $K_{2,3}$ and $K_{3,3}$.
21. Explain Hamiltonian paths and circuits.

(6 × 2 = 12 weightage)

Section C

Answer any **three** *questions.*
Each question carries 4 *weightage.*

22. Obtain the PDNF for $(P \wedge Q) \vee (\neg P \wedge R) \vee (Q \wedge R)$.
23. Distinguish between symmetric and transitive relation with suitable examples.
24. Define Group. List and explain properties of Groups. Explain Permutation groups and Cyclic groups with examples.
25. Illustrate pigeon hole principle and its applications.
26. Prove that the maximum number of edges in a simple graph with n vertices is
27. In a Lattice, show that $a \leq b$ and $c \leq d$ implies $a * c \leq b * d$.

(3 × 4 = 12 weightage)

D 12278 (Pages : 2) Name.....

Reg. No.....

FIRST SEMESTER P.G. DEGREE EXAMINATION, NOVEMBER 2021

(CCSS)

Computer Science

CSC 1C 05—COMPUTER ORGANIZATION AND ARCHITECTURE

(2019 Admissions)

Time : Three Hours Maximum : 80 Marks

Answer any **five** *full questions.*

1. (a) Explain the logic circuit, characteristics and excitation table of JK and SR flip-flop.

   (b) State the postulates and theorem of Boolean Algebra.

   (10 + 6 = 16 marks)

2. (a) Explain Booth's algorithm for two complement multiplication.

   (8 marks)

   (b) Draw the block diagram of the hardware implementation of addition and subtraction of signed numbers.

   (8 marks)

3. (a) What an instruction cycle ? Explain the different steps in instruction cycle. (8 marks)

   (b) What are the major differences between microinstruction and program sequence ? Also list the different types of microinstruction.

   (8 marks)

4. (a) Explain any one method for translating virtual address to physical address with a diagram.

   (8 marks)

   (b) What is the advantage of DMA controlled data transfer over interrupt driven data transfer ? Why are DMA controlled data transfers faster ?

   (8 marks)

5. (a) Discuss the different addressing modes in 8086 microprocessors. (8 marks)

   (b) Explain the architecture of Intel 8051 microcontroller. (8 marks)

Turn over

6. (a) What is an interrupt ? Explain the different types of interrupt and the different way of handling it.

(8 marks)

(b) Explain memory hierarchy with suitable diagram. (8 marks)

7. (a) State and explain the various Instruction formats in 8085 microprocessors. (8 marks)

(b) Give an account in I/O channels. (8 marks)

8. (a) Explain non-restoring division algorithm for unsigned integers with example.

(b) Simplify using K-Map : f (A, B, C, D) (0, 2, 5, 7, 8, 10, 13, 15).

(8 + 8 = 16 marks)

D 12277 (Pages : 2) Name.....

Reg. No.....

FIRST SEMESTER P.G. DEGREE EXAMINATION, NOVEMBER 2021

(CCSS)

Computer Science

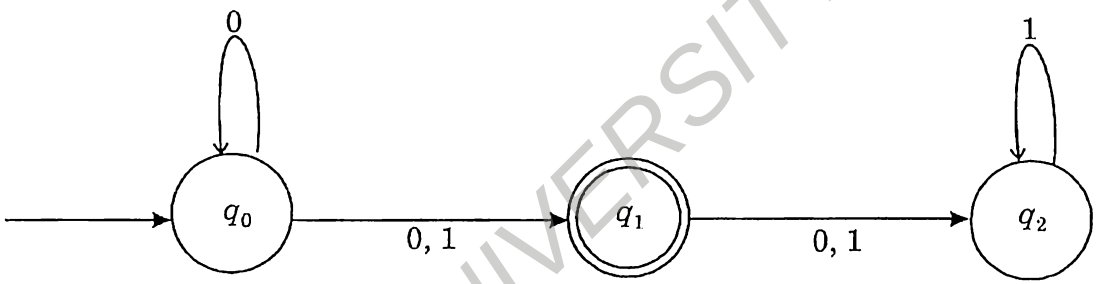
CSC1C04—THEORY OF COMPUTATION

(2019 Admissions)

Time : Three Hours Maximum : 80 Marks

Answer any **five** *full questions.*

1. (a) Convert the given NFA into an equivalent deterministic machine :



(8 marks)

(b) Give regular expressions for the following languages.

(i) $L_1 = \{a^n b^m, n \geq 4, m \leq 3\}$

(ii) $L_2 = \{a^n b^m, n < 4, m \leq 3\}$.

(8 marks)

2. (a) Briefly explain any two applications of CFG. (8 marks)

(b) Write short notes on :

(I) Greibach Normal form (GNF).

(II) Chomsky Normal form (CNF).

(8 marks)

Turn over

3. Write short notes on the following :

   (I) CSG.

   (II) CFL.

   (III) CFG.

   (IV) Regular Language.

   (16 marks)

4. (a) Design a Turing machine that multiplies two positive integers in unary notation.

   (8 marks)

   (b) Write short notes on :

   (I) Notational Conventions for Turing machine.

   (II) Language of a Turing machine.

   (8 marks)

5. (a) Prove that the set of all languages that are not recursively enumerable is not countable.

   (8 marks)

   (b) Define a P problem, Explain it with an example.

   (8 marks)

6. (a) Briefly explain Pushdown Automata. (8 marks)

   (b) Prove that in DFA the equivalence of states is transitive. (8 marks)

7. (a) Differentiate P and NP problem with an example. (8 marks)

   (b) Explain Turing machine with Semi-Infinite tape with a diagram. (8 marks)

8. (a) Explain family of context free languages is closed under union, concatenation and star-closure.

   (8 marks)

   (b) Convert the grammar S -> aSb | ab into Chomsky Normal form.

   (8 marks)

D 12276 (Pages : 2) Name.....

Reg. No.....

FIRST SEMESTER P.G. DEGREE EXAMINATION, NOVEMBER 2021

(CCSS)

Computer Science

CSC 1C 03—PRINCIPLES OF PROGRAMMING METHODOLOGY

(2019 Admissions)

Time : Three Hours Maximum : 80 Marks

Answer any **five** *full questions.*

1. A) What are the different types of programming errors ? Explain each one. (6 marks)

   B) Draw the flowchart to find the solution of a quadratic equation. (6 marks)

   C) Write a short note on modular programming approach. (4 marks)

2. A) What are the fundamental data types in C ? Explain each one with examples. (8 marks)

   B) Explain the syntax and function of *for* loop construct in C with illustration. (8 marks)

3. A) What are the different categories of user defined functions in C? Explain each one with suitable example. (8 marks)

   B) Write a C program to multiply two suitable matrices. (8 marks)

4. A) Explain how the pointer variables are created and initialized in C. (4 marks)

   B) Compare and contrast structure and union data types in C. (6 marks)

   C) Write a C program to find the sum of elements in a one-dimensional array using pointers. (6 marks)

5. A) Explain the structure and mapping techniques of ISAM files. (8 marks)

   B) Write a C program to append the contents of one file at the end of another file. (8 marks)

6. A) What is recursion ? Write a recursive function to generate n Fibonacci numbers. (8 marks)

   B) Write a note on storage classes in C. (8 marks)

7. A) Give an account on different types of operators in C. (8 marks)

   B) What is string variable ? Explain how it is declared and initialized in C. Also explain any two string handling functions in C. (8 marks)

8. A) Write a C program to put all the members of an array of structures to a file using *fwrite*() function. Read the content of array from file and display it on the screen.

(6 marks)

B) Differentiate between call-by-value and call-by-reference with example. (6 marks)

C) Explain how sequential files differ from random access files. (4 marks)

[5 × 16 = 80 marks]

D 12275 (Pages : 2) Name.....

Reg. No.....

FIRST SEMESTER P.G. DEGREE EXAMINATION, NOVEMBER 2021

(CCSS)

Computer Science

CSC 1C 02—ADVANCED DATA STRUCTURES AND ALGORITHMS

(2019 Admissions)

Time : Three Hours Maximum : 80 Marks

Answer any **five** *questions.*

1. (a) What are the different complexity measures of an algorithm ? Explain. (8 marks)

   (b) Compare and contrast linear search and binary search algorithms. (8 marks)

2. (a) What is linear linked list ? Give an algorithm for adding a node at the beginning of the linear linked list.

   (8 marks)

   (b) What is slack ? Explain the different operations on stack. (8 marks)

3. (a) Construct a tree for the given inorder and postorder traversals :

   Inorder : DGBAHEICF

   Postorder : GDBHIEFCA

   (8 marks)

   (b) List the types of Binary Search Tree. Explain Insertion and Deletion Operation on Binary Search Tree with example.

   (8 marks)

4. (a) What is Hashing ? Explain different Hashing methods. (8 marks)

   (b) Explain linear probing with an example. (8 marks)

5. (a) What is heap ? Explain the variations of heap. Also construct a heap using 6, 3, 7, 18, 9, 40.

   (b) Explain bubble sort algorithm with an example.

   (10 + 6 = 16 marks)

Turn over

6. (a) Explain Breadth First Search traversal of Graph using an example. (8 marks)

   (b) Compare and contrast dequeue and priority queue. (8 marks)

7. (a) What do you mean by data abstraction ? Explain the different abstract data types.

   (b) Write merge sort algorithm to sort the following numbers 14, 17, 18, 12, 9, 7, 11, 34, 21, 11. Derive the best and the worst-case time complexity of merge sort algorithm.

   (8 + 8 = 16 marks)

8. (a) Give an account on different types of arrays. Also explain the various operations on arrays. (8 marks)

   (b) What is AVL tree ? Explain. (4 marks)

   (c) Write short note on Hash tables. (4 marks)

D 12274 **(Pages : 3)** **Name.....**

Reg. No.....

FIRST SEMESTER P.G. DEGREE EXAMINATION, NOVEMBER 2021

(CCSS)

Computer Science

CSC 1C 01—DISCRETE MATHEMATICAL STRUCTURES

(2019 Admissions)

Time : Three Hours Maximum : 80 Marks

Answer any **five** *full questions.*

1. (a) Explain in detail about the basic Logical Connectives with Examples. (8 marks)

   (b) Use truth table to verify the statement $[p \to q \vee r] \leftrightarrow [\sim r \to (p \to r)]$. (4 marks)

   (c) Define Well-formed formula. What are the rules to generate Well-formed formula ? (4 marks)

2. (a) How do you describe set operations using Venn diagram ? (5 marks)

   (b) Show the $|A \cup B| = |A| + |B| - |A \cap B|$ for any two sets A and B. (5 marks)

   (c) Let R be a relation on the set A = {*a*, *b*, *c*} defined by :

   $R = \{(a,b),(b,c),(d,c),(d,a),(a,d),(d,d)\}$. Write the relation matrix of R and find (i) reflexive closure of R ; (ii) symmetric closure of R ; and (iii) transitive closure of R. (6 marks)

3. (a) Let *f*, *g* and $h : R \to R$ be defined by (R is the set of real numbers)

   $f(x) = x + 2, g(x) = (1 + x^2) - 1, h(x) = 3.$

   Compute $f^{-1}g(x)$ and $hf(g\, f^{-1})(hf(x))$. (5 marks)

   (b) State and prove Pigeonhole principle. (5 marks)

   (c) Define partially ordered set and Hasse diagram. Let S = {*a*, *b*, *c*} then the power set $P(S) = \{\varphi, \{a\}, \{b\}, \{c\}, \{a,b\}, \{a,c\}, \{b,c\}, \{a,b,c\}\}$ is a Poset with respect to the relation inclusion $\subseteq$. Draw the Hasse diagram,. (6 marks)

Turn over

4. (a) Let G_1 and G_2 be subgroup of a group G :

   (i) Show that $G_1 \cap G_2$ is also a subgroup of G.

   (ii) Is $G_1 \cup G_2$ is always a subgroup of G.

   (8 marks)

   (b) Define Group, Subgroup and Cyclic groups. What are the elementary properties of groups ? Explain with example.

   (8 marks)

5. (a) Write a note on the following :

   (i) Prims algorithm.

   (ii) Directed and Undirected graph.

   (8 marks)

   (b) Define Eulerian and Hamiltonian graph. Give an example of a graph which is :

   (i) Eulerian but not Hamiltonian.

   (ii) Hamiltonian but not Eulerian.

   (iii) Hamiltonian and Eulerian.

   (iv) Neither Hamiltonian nor Eulerian.

   (8 marks)

6. (a) Let A = { a, b, c, d} and let R be the relation on A that has the matrix :

$$M_R = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 \end{bmatrix}$$

   Construct the digraph of R, and list in-degrees and out-degrees of all vertices.

   (6 marks)

   (b) (i) Check whether $(A \cup B) \cap C = A \cup (B \cap C)$ or not, using Venn diagram.

   (ii) Find the dual of $A \cup (B \cup C)$.

   (6 marks)

   (c) Let $A = \{a,b,c,d\}$, $B = \{1,2,3\}$, $R = \{(a,2),(b,1),(c,2),(d,1)\}$. Is R a function ? Why ?

   (4 marks)

7. (a) (i) Write the negation of "If x is an integer then x is a rational number."

(ii) Find CNF of $\sim(p \vee q) \leftrightarrow (p \wedge q)$. (6 marks)

(b) Write a note on Free and bound variables. (4 marks)

(c) Prove that $(\exists x)(P(x) \wedge Q(x)) \Rightarrow (\exists x)P(x) \wedge (\exists x)Q(x)$. (6 marks)

8. Write a note on the following :

(a) Closure of relations.

(b) Lagrange's theorem.

(c) Rings.

(d) Bipartite graphs.

(16 marks)