MASTER OF COMPUTER APPLICATIONS (MCA)

MCA/ASSIGN/SEMESTER-III

ASSIGNMENTS

(July - 2022 & January - 2023)

MCS-031, MCS-032, MCS-033, MCS-034, MCS-035, MCSL-036

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THE PEOPLE'S
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SCHOOL OF COMPUTER AND INFORMATION SCIENCES
INDIRA GANDHI NATIONAL OPEN UNIVERSITY
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Important Notes

1. Submit your assignments to the Coordinator of your Study Centre on or before the due date.

2. Assignment submission before due dates is compulsory to become eligible for appearing in corresponding Term End Examinations. For further details, please refer to MCA Programme Guide.

3. To become eligible for appearing the Term End Practical Examination for the lab courses, it is essential to fulfill the minimum attendance requirements as well as submission of assignments (on or before the due date). For further details, please refer to the MCA Programme Guide.

4. The viva voce is compulsory for the assignments. For any course, if a student submitted the assignment and not attended the viva-voce, then the assignment is treated as not successfully completed and would be marked as ZERO.

Course Code	:	MCS-031
Course Title	:	**Design and Analysis of Algorithms**
Assignment Number	:	**MCA(III)031/Assign/2022-23**
Maximum Marks	:	**100**
Weightage	:	**25%**
Last Date of Submission	:	**31st October, 2022 (for July session)**
		15th April, 2023 (for January session)

This assignment has 8 questions of 80 marks (All questions carry equal marks i.e. 10 marks). Answer all the questions. Rest 20 marks are for viva voce. You may use illustrations and diagrams to enhance explanations. Please go through the guidelines regarding assignments given in the Programme Guide for the format of presentation.

Q1. Write Quick Sort Algorithm. How is it Different from Randomized Quick Sort Algorithm? Prove that Worst case of Quick Sort is Best case of Bubble Sort. Apply Quick sort Algorithm to sort the following list: Q U I C K S O R T, in alphabetical order. Find the element whose position is unchanged in the sorted list. **(10 marks)**

Q2. Explain how dynamic programming reduces the complexity of a simple algorithm? Also explain the matrix chain multiplication algorithm in this context. Derive the principle of optimality for multiplication of matrix chain. Compute the optimal multiplications required following matrices.

A1 of order 30 x 35;   A2 of order 35 x 15;   A3 of order 15 x 5 **(10 marks)**

Q3. Perform the Following: **(10 marks)**

(i)   Write a context free grammar to generate palindromes of even length Over alphabet $\sum$= {a, b}.

(ii)   Write the finite automata corresponding to the regular expression (a+b)*ab.

(iii)   Explain the Chomsky's Classification of grammars. What is an ambiguous grammar? How do you prove that a given grammar is ambiguous? Explain with an example.

(iv)   If L_1 and L_2, are context free languages then, prove that L_1 U L_2 is a context free language.

(v)   Construct a Turing machine that copies a given string over {a, b}. Further find a computation of TM for the string 'aab'.

Q4. Using Dijkstra's algorithm, find the minimum distances of all the nodes from source node 'a' for the following graph: **(10 marks)**
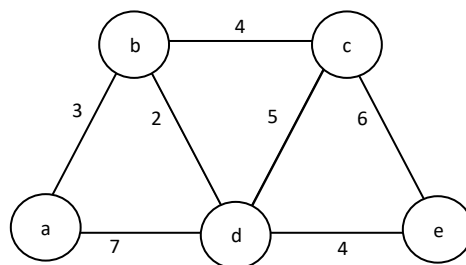
Q5. Obtain the minimum cost spanning tree for the following graph using Kruskal's algorithm.

(10 marks)
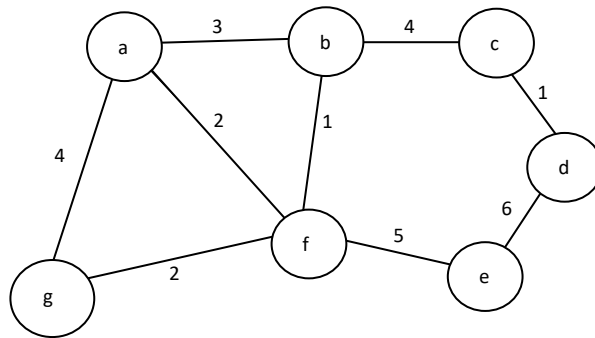
Q6. Enumerate five important characteristics of an Algorithm and Discuss any five well-known techniques for designing algorithms to solve problems. State Travelling Salespersons problem. Comment on the nature of solution to the problem. **(10 marks)**

Q7. Compare and Contrast the following and give suitable example for each **(10 marks)**

    a) NP-hard problems and NP complete Problems.
    b) Push Down Automata and Turing Machine
    c) Decidable problems and Undecidable problems
    d) Greedy Techniques and Divide & Conquer Techniques
    e) Greedy technique and Dynamic programming technique

Q8. Write note on each of the following: **(10 marks)**
    1. Vertex Cover Problem
    2. Rice theorem
    3. Post correspondence problem
    4. Halting problem
    5. Strassen's Algorithm

Course Code	:	MCS-032
Course Title	:	**Object Oriented Analysis and Design**
Assignment Number	:	**MCA (III)/032/Assign/2022-23**
Maximum Marks	:	**100**
Weightage	:	**25%**
Last Date of Submission	:	**31ˢᵗ October, 2022 (for July session)**
		15ᵗʰ April, 2023 (for January session)

There are eight questions in this assignment, which carried 80 marks. Rest 20 marks are for viva-voce. Answer all the questions. Please go through the guidelines regarding assignments given in the Program Guide for the format of presentation. Use diagram as part of answer wherever required for better explanation.

Q1. What is OOAD? Explain why OOAD is better that structured   analysis and design of system?

(10 Marks)

Q2. What is UML diagram? Draw class diagram for Online Examination System. **(10 Marks)**

Q3. What is Use Case diagram? Draw Use Case diagram for Online Examination System. **(10 Marks)**

Q4. What is aggregation? Explain difference between aggregation and inheritance with the help of example using suitable diagram. **(10 Marks)**

Q5. Draw a sequence diagram of an ATM System of a bank. **(10 Marks)**

Q6. What is State Diagram? Draw State Diagram for Online Examination System. **(10 Marks)**

Q7. Draw a DFD upto 2ⁿᵈ level for Online Examination System. Make necessary assumptions required. **(10 Marks)**

Q8. Write short note on followings (minimum in 300 words) **(10 Marks)**
- i) Object ID and Persistency
- ii) Inheritance Adjustment
- iii) Implementation of Associations
- iv) Integrity Constraints

Answer all the questions in the assignment which carry 80 marks in total. 20 marks are for viva voce. You may use illustrations. Place go through the guidelines regarding assignments given in the Programme Guide for the format of presentation.

Q1. Find the order and degree of the following recurrence relations. Also state whether they are homogeneous or non-homogeneous. **(7 Marks)**

(i) $a_n = a_{n-1}^2 + a_{n-2} a_{n-3} a_{n-4}$
(ii) $d_n = nd_{n-1} + (-1)^n$

Q2. A person climbs a staircase by climbing either (i) two steps in a single stride or (ii) only one step in a single stride. Find the recurrence relation of No. of ways of climbing n stairs. **(4 Marks)**

Q3. Describe the binary search problem and formulate it as a recurrence relation problem using **divide & conquer** method. Show all the intermediate steps. **(4 Marks)**

Q4. (a) What is spanning tree? Give two examples of it. **(3 Marks)**

(b) What is Chromatic Number? Find the Chromatic Number of the complete bipartite graph $K_{2,3}$ **(5 Marks)**

Q5. Solve the recurrence relation $a_n = 6a_{n-1} - 8a_{n-2}$ with $a_0 = 1$ and $a_1 = 0$ by applying a substitution method. **(6 Marks)**

Q6. (a) Solve $T_n = 2T_{n-1} + 1$ if n $\geq$ 2 and $T_1 = 1$ **(5 Marks)**

(b) Find the generating function for the sequence 2, 4, 8, 16, 32 .... **(6 Marks)**

Q7. (a) Explain the process of solving a recurrence relation by iterations with the help of an example. **(5 Marks)**
(b) Explain the steps required to solve the linear homogeneous recurrence relation with constant coefficients through characteristic equation. **(6 Marks)**

Q8. State & prove the handshaking theorem. **(4 Marks)**

Q9. Show that for a subgraph H of graph G, $\Delta(H) \leq \Delta(G)$ **(5 Marks)**

Q10. Give an example of a graph having Euler's circuit & Hamiltonian circuit. **(5 Marks)**

Q11. A graph consists of four vertices each of degree three and an isolated vertices.

Find the No. of edges in the graph. **(5 Marks)**

Q12. Perform an edge coloring of Grotzsch graph. Write steps involved. **(5 Marks)**

Q13 . Given a connected planar graph with p = 4, q = 6, calculate the number of regions r.

(5 Marks)

Course Code	:	MCS-034
Course Title	:	Software Engineering
Assignment Number	:	MCA(III)/034/Assign/2022-23
Maximum Marks	:	100
Weightage	:	25%
Last Dates for Submission	:	31st October, 2022 (for July session)
		15th April, 2023 (for January session)

This assignment has one question for 80 marks. 20 marks are for viva voce. You may use illustrations and diagrams to enhance the explanations. Please go through the guidelines regarding assignments given in the Programme Guide for the format of presentation.

Q1.

Assume that you are assigned responsibility of developing an **Online Appointment Booking System (OABS)** for Doctors of a Hospital. **OABS** will have all fields such as Name of Doctor, Specialization, Branch of Hospital, Patient Name, e-mail address, Mobile Number etc. There should be provision for generation of reports. Make necessary assumptions.

For developing **OABS as** specified above,

    (a)   Which SDLC paradigm will be selected. Justify your answer.   **(10 Marks)**
    (b)   List the functional and non-functional requirements.   **(20 Marks)**
    (c)   Estimate cost.   **(15 Marks)**
    (d)   Estimate effort.   **(15 Marks)**
    (e)   Develop SRS using IEEE format.   **(15 Marks)**
    (f)   List queries for whom Reports can be generated   **(5 Marks)**

Course Code   :   MCS-035
Course Title   :   **Accountancy and Financial Management**
Assignment Number   :   **MCA(III)/035/Assign/2022-23**
Maximum Marks   :   **100**
Weightage   :   **25%**
Last Dates for Submission : **31ˢᵗ October, 2022 (For July Session)**
                              15ᵗʰ April, 2023 (For January Session)

This assignment has five questions. Answer all questions. 20 marks are for viva voce. You may use illustrations and diagrams to enhance the explanations. Please go through the guidelines regarding assignments given in the Programme Guide for the format of presentation.

Q1. 'The history of accounting indicates the evolutionary pattern which reflects changing socio-economic conditions, and the enlarged purposes to which accounting is applied'. In light of the above statement, briefly explain the different phases of the evaluation of accounting**.**   **(16 Marks)**

Q2. The following is the Trading and Profit and Loss A/C and Balance Sheet of a firm:

Trading and Profit and Loss Account

Particular	Rs.	Particular	Rs.
To Opening Stock	10,000		1,00,000
To Purchases	55,000		15,000
To Gross Profit	50,000		
	1,15,000		**1,15,000**
		By Gross Profit b/d	50,000
To Administration Expenses	15,000		
To Interest	3,000		
To Selling Expenses	12,000		
To Net Profit	20,000		
	50,000		**50,000**

Balance Sheet

Liabilities	Rs.	Assets	Rs.
Capital	1,00,000	Land and Buildings	50,000
Profit and Loss A/C	20,000	Plant and Machinery	30,000
Creditors	25,000	Stock	15,000
Bills Payable	15,000	Debtors	15,000
		Bills Receivable	12,500
		Cash at Bank	17,500
		Furniture	20,000
	1,60,000		**1,60,000**

Calculate the following ratios: (1) Inventory turnover ratio (2) Current ratio (3) Gross profit ratio (4) Net Profit (5) Operating ratio (6) Liquidity ratio (7) Proprietary ratio   **(16 Marks)**

Q3. What is meant by the 'Internal Rate of Return' of a project? How do you calculate I.R.R (Internal Rate of Return) given the initial investment on the Project and cash flows arising during the expected life of the Project? How is IRR different from MIRR?   **(16 Marks)**

Q4. Compare and contrast the traditional and modern techniques of inventory valuation. Write down the formulas wherever required. **(16 Marks)**

Q5. Define the concept of Receivables Management. Discuss the various credit policy variables and explain the effect of relaxing these variables on the net profit of the firm**.** **(16 Marks)**

Course Code	:	MCSL-036
Course Title	:	**Lab course for OOAD, S/E and Accountancy &**
		Financial Management
Assignment Number	:	**MCA(III)/L036/Assign/2022-23**
Maximum Marks	:	**100**
Weightage	:	**25%**
Last Dates for Submission	:	**31st October, 2022 (For July Session)**
		15th April, 2023 (For January Session)

The assignment has three components. Answer all the questions in each section. Assignment marks of section A, section B and section C are 13, 13 and 14 respectively. The lab records of section A, section B and section C carry 13, 13 and 14 respectively. The rest 20 marks are for Viva voce.

Section A: Object Oriented Analysis and Design

Q1. A Software company wants to develop a Bike On Rent booking app having the following features:

- Registration/login
- Real-time tracking
- Navigation feature
- End of the trip option
- Different stop option
- Cash payment option/Online payment option
- Estimated time of arrival
- Features to calculate the price before riding
- Review and rating system

Do the following tasks (make necessary assumption state it):

(1) Draw a use case diagram **(2 Marks)**

(2) Define all classes and the class diagram **(4 Marks)**

(3) Draw a simple object model **(4 Marks)**

(4) Draw a state transition diagram **(3 Marks)**

Section B: MCS-34: Software Engineering

Q2. For the Bike booking app problem discussed in a section A do the following tasks:
    a) Develop SRS **(4 Marks)**
    b) Draw Data Flow Diagrams (Level0 and Level1) **(4 Marks)**
    c) Draw an E-R diagram and its related normalized tables **(5 Marks)**

Section C: MCS-035: Accountancy and financial Management

Q3. Post the following transactions of a chemist shop to prepare the journal, ledger and trial balance:

(14 Marks)

March 2022	Transaction	Amount
5th March	Started business with cash	1,70000.00
10 March	Deposited In the bank	40,000.00
15 March	Purchased medicines on credit	50,000.00
18 March	Purchased medical equipment on credit	30,000.00
20 March	Purchase Furniture for cash	35,000.00
22 March	Sold medicines for cash	40,000.00
25 March	Sold medicine on credit	60,000.00
27 March	Paid salary to staff	30,000.00
31 March	Paid rent	15,000.00