

# **MASTER OF COMPUTER APPLICATIONS (MCA)**

**MCA/ASSIGN/SEMESTER-III**

**ASSIGNMENTS**

**(July - 2020 & January - 2021)**

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



**SCHOOL OF COMPUTER AND INFORMATION SCIENCES  
INDIRA GANDHI NATIONAL OPEN UNIVERSITY  
MAIDAN GARHI, NEW DELHI – 110 068**

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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.

<b>Course Code</b>	:	<b>MCS-031</b>
<b>Course Title</b>	:	<b>Design and Analysis of Algorithms</b>
<b>Assignment Number</b>	:	<b>MCA(III)/031/Assign/2020-21</b>
<b>Maximum Marks</b>	:	<b>100</b>
<b>Weightage</b>	:	<b>25%</b>
<b>Last Dates for Submission</b>	:	<b>31<sup>st</sup> October, 2020 (For July, 2020 Session)</b>
	:	<b>15<sup>th</sup> April, 2021 (For January, 2021 Session)</b>

**There are eight questions in this assignment, which carries 80 marks. Rest 20 marks are for viva-voce. Answer all the questions. You may use illustrations and diagrams to enhance the explanations. Please go through the guidelines regarding assignments given in the MCA Programme Guide for the format of presentation. The examples, whenever asked to be given, should be different from those that are discussed in the course material.**

**Q1:** Write Merge sort algorithm. Determine its complexity in Best, Average and Worst Case. Sort the following sequence in increasing order: 35, 37, 18, 15, 40, 12; Using Merge Sort.

**(10**

**marks)**

**Q2:** Explain how using 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:** Give a divide and conquer based algorithm (Write a pseudo-code) to perform following:

- (i) find the is largest element in an array of size n. Derive the running time complexity of your algorithm.
- (ii) finding the position of an element in an array of  $n$  numbers

Estimate the number of key comparisons made by your algorithms.

**(10**

**marks)**

**Q4:** Write Quick Sort Algorithm. How is it Different from Randomized Quick Sort Algorithm? Prove that 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)**

**Q5: Answer the following:**

**(10 marks)**

- (i) Explain the meaning of Big O notation with suitable example. How does it differ from Theta and Omega notations. Arrange the following growth rates in increasing order:  
 $O(3n)$ ,  $O(n^2)$ ,  $O(1)$ ,  $O(n \log n)$
- (ii) Explain the essential idea of Dynamic Programming. How Dynamic programming differs from Divide and conquers approach for solving problems?

- (iii) Define Knapsack Problem and cite one instance of the problem. Compare Knapsack Problem with fractional Knapsack problem. Give a Greedy algorithm for fractional Knapsack Problem.
- (iv) Write pseudo code for DFS and calculate its time complexity. Explain briefly how DFS differs from BFS
- (v) Write Prim's Algorithm. How Prim's algorithm differs from Kruskal's algorithm. Illustrate with the help of an example

**Q6: Answer the following:**

**(10 marks)**

- (i) Write a context free grammar to generate palindromes of even length Over alphabet  $\Sigma = \{a, b\}$ .
- (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  $L_1 \cup L_2$  is a context free language.
- (v) Construct a turing machine that copies agiven string over  $\{a, b\}$ . Further find a computation of TM for the string 'aab'.

**Q7: Differentiate between :**

**(10 marks)**

- (i) Strassen's Algorithm & Chain Matrix Multiplication algorithm
- (ii) Context free & Context sensitive Language
- (iii) NP-Complete & NP Hard Problem
- (iv) Greedy technique and Dynamic programming technique
- (v) Decidable & Un-decidable problems

**Q8: Write note on each of the following:**

**(10 marks)**

- (i) Verte Cover Problem
- (ii) Rice theorem
- (iii) Post correspondence problem
- (iv) Halting problem
- (v) K-colourability problem

<b>Course Code</b>	:	<b>MCS-032</b>
<b>Course Title</b>	:	<b>Object Oriented Analysis and Design</b>
<b>Assignment Number</b>	:	<b>MCA (III)/032/Assignment/2020-21</b>
<b>Maximum Marks</b>	:	<b>100%</b>
<b>Weightage</b>	:	<b>25%</b>
<b>Last Dates for Submission</b>	:	<b>31<sup>st</sup> October, 2020 (For July, 2020 Session)</b>
	:	<b>15<sup>th</sup> April, 2021 (For January, 2021 Session)</b>

**There are eight questions in this assignment which carried 80 marks. Rest 20 marks are for viva-voce. Answer all the questions. Wherever required, you may write C++/java program, as part of solutions. Please go through the guidelines regarding assignments given in the Program Guide for the format of presentation.**

**Q1:** What is OOAD? Explain advantages of OOAD over structured system analysis and design. **(10 Marks)**

**Q2:** What is Generalization? How is it different from Specialization explain with the help of examples and UML diagrams. **(10 Marks)**

**Q3:** What is a class? How class is different from object? Draw an Object diagram for Online Banking System. **(10 Marks)**

**Q4:** (a) Explain advantage of use case diagram with the help of an example. **(5 Marks)**

(b) Draw a sequence diagram for Online Railway Ticket Booking. **(5 Marks)**

**Q5:** (a) What is need of concurrency control is object oriented system modeling? Explain with of example. **(5 Marks)**

(b)What is aggregation? Explain with an example. **(5 Marks)**

**Q6:** What is Association? What are its types? Explain how Associations are implemented with the help of an example. **(10 Marks)**

**Q7:** Draw a 1<sup>st</sup> and 2<sup>nd</sup>level DFDs for Online Banking System. Make necessary assumptions required. **(10 Marks)**

**Q8:** Write short note on followings (minimum in 300 words) : **(10 Marks)**

- i) UML Diagrams
- ii) States of a System
- iii) Integrity Constraints
- iv) Persistent Objects

<b>Course Code</b>	:	<b>MCS-033</b>
<b>Course Title</b>	:	<b>Advanced Discrete Mathematics</b>
<b>Assignment Number</b>	:	<b>MCA(III)/033/Assignment/2020-21</b>
<b>Maximum Marks</b>	:	<b>100</b>
<b>Weightage</b>	:	<b>25%</b>
<b>Last Dates for Submission</b>	:	<b>31<sup>st</sup> October, 2020 (For July, 2020 Session)</b>
	:	<b>15<sup>th</sup> April, 2021 (For January, 2021 Session)</b>

**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.** Is a Hamiltonian graph Eulerian ? Is a Eulerian graph Hamiltonian ? Show (5 Marks) with the help of a suitable example.
- Q2. (a)** Solve  $a_{n+1} + 1 = 5a_n$  for  $n \geq 0$ ,  $a_0 = 2$  by Substitution method. (5 Marks)
- (b)** Solve the recurrence by using iterative approach : (5 Marks)  
 $a_n = a_{n-1} + 2n + 3$ ,  $a_0 = 4$ .
- Q3.** Define a recurrence relation. Describe the following problems with the (10 Marks) help of examples which can be solved through Divide and Conquer technique and Show its recurrence relation.  
 (i) Binary Search  
 (ii) Merge Sort  
 Solve these recurrence relations with a substitution method.
- Q4.** To multiply two n-digit numbers, one must do normally  $n^2$  digit-times-digit multiplications. Use a divide and conquer algorithm to propose an (5 Marks) algorithm when n is a power of 2.
- Q5.** Find a recurrence relation and initial conditions for 4, 14, 44, 134, 404, ... (5 Marks)
- Q6.** Prove/show the followings: (16 Marks)
- the sum of the degrees of the vertices of G is twice the number of edges
  - If W is a u-v walk joining two distinct vertices u and v, then there is a path joining u and v contained in the walk using the principles of mathematical induction
  - A connected graph G is Eulerian **if and only if** the degree of each of its vertices is even.
  - If G is a connected planar (p,q)-graph, then the number r of the

regions of  $G$  is given by  $r = q - p + 2$

- Q7.** Show the followings: **(8 Marks)**
- Show that for a subgraph  $H$  of a graph  $G$ ,  $\Delta(H) \leq \Delta(G)$
  - Show that  $K_{m,n}$  is not Hamiltonian when  $m + n$  is odd
- Q8.** Define homogeneous recurrence relation. Write the first order and second order homogeneous recurrence relations with constant coefficients giving an example for each. Solve the following recurrence relation: **(6 Marks)**  
 $a_n + a_{n-1} - 6a_{n-2} = 0$  for  $n \geq 2$  given that  $a_0 = -1, a_1 = 8$
- Q9.** (a) Find chromatic number of bipartite graph  $K_m, n$ . **(4 Marks)**  
(b) Show that  $K_{3,3}$  is non-planar. **(3 Marks)**  
(c) Construct a 5-regular graph on 10 vertices. **(3 Marks)**
- Q10.** Solve the recurrence  $a_n = a_{n-1} + 2; a_0 = 3$  **(5 Marks)**

<b>Course Code</b>	:	<b>MCS-034</b>
<b>Course Title</b>	:	<b>Software Engineering</b>
<b>Assignment Number</b>	:	<b>MCA(3)/034/Assign/2020-21</b>
<b>Maximum Marks</b>	:	<b>100</b>
<b>Weightage</b>	:	<b>25%</b>
<b>Last Dates for Submission</b>	:	<b>31<sup>st</sup> October, 2020 (For July, 2020 Session)</b>
	:	<b>15<sup>th</sup> April, 2021 (For January, 2021 Session)</b>

**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 Admission System (OAS)** for a University. **OAS** will have all fields such as Student's name, address, Mobile number, email, AadhaarNumber, PAN Number, Educational Qualifications, etc. **OAS** will also have provision for student to upload the copies or all relevant documents. **OAS** should generate a provisional Enrollment number and also assign a Study Center to the student. There should be provision for generation of reports. Make necessary assumptions.

For developing **OAS** as specified above,

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



Course Code	:	<b>MCS-035</b>
Course Title	:	<b>Accountancy and Financial Management</b>
Assignment Number	:	<b>MCA(III)/035/Assignment/2020-21</b>
Maximum Marks	:	<b>100</b>
Weightage	:	<b>25%</b>
Last Dates for Submission	:	<b>31<sup>st</sup> October, 2020 (For July, 2020 Session)</b>
	:	<b>15<sup>th</sup> April, 2021 (For January, 2021 Session)</b>

**Note: 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.** From the following Trial Balance of Raghu Ram Associates, prepare **(16 Marks)** Trading and Profit & Loss Account for the year ended 31st December, 2019 and a Balance Sheet as on that date:-

Dr. Balances	Rs.	Cr. Balances	Rs.
Opening Stock	22,000	Sales	3,70,000
Purchases	1,80,000	Purchase Return	5,000
Sales Return	7,000	Discount	6,200
Carriage Inwards	2,600	Sundry Creditors	27,000
Carriage Outwards	800	Bills Payable	2,800
Wages	40,000	Capital	70,000
Salaries	27,500		
Plant & Machinery	1,00,000		
Furniture	8,000		
Sundry Debtors	42,000		
Bills Receivable	2,500		
Cash in Hand	6,500		
Travelling Expenses	3,500		
Lighting	2,400		
Rent and Taxes	6,200		
General Expenses	8,500		
Insurance	1,500		
Drawings	20,000		
	<b>4,81,000</b>		<b>4,81,000</b>

**Adjustments:-**

- (1) Stock on 31st December, 2019 was valued at Rs. 25,000 (Market Value Rs. 35,000).
- (2) Wages outstanding for December, 2019 amounted to Rs. 5,000.
- (3) Salaries outstanding for December, 2019 amounted to Rs. 3000.
- (4) Prepaid insurance amounted to Rs. 500.
- (5) Provide depreciation on Plant and Machinery at 5% and on Furniture at 20%.

**Q2.** Following are the balance sheets of Shanti Niketan limited as on 31st (16 Marks) December, 2018 and 2019.

<b>Liabilities</b>	2018 (Rs.)	2019 (Rs.)	<b>Assets</b>	2018 (Rs.)	2019 (Rs.)
Share Capital	65,000	85,000	Goodwill	3,000	2,500
Reserves	12,000	14,500	Buildings	52,000	50,000
P. & L A/c	8,600	9,000	Plant	40,000	41,000
Bank loan (Long-term)	20,000	---	Stock	20,500	18,800
Creditors	40,000	35,000	Debtors	41,000	36,200
Bills Payable	11,000	7,500	Cash	100	650
			Bank	---	1,850
	1,56,600	1,51,000		1,56,600	1,51,000

Taking into account the following additional information, you are required to prepare funds flow statement and statement of changes in working capital.

- (a) Dividend paid was Rs.6,000/-
- (b) Rs.3,600/- was written off as depreciation on plant and Rs.2,950/- on buildings.
- (c) Profit on sale of plant was Rs.3,000/-

**Q3.** Describe the main ratios which you consider significant while interpreting (16 Marks) the published accounts of a Company and explain the inferences which may be drawn from them.

- Q4.** “For most investment decisions that a firm faces, NPV is either a superior (16 Marks) decision criterion, or is at least as good as the competing techniques.” In what investment situation is the profitability index better than the NPV?
- Q5.** “Efficient cash management will aim at maximizing the cash inflows and (16 Marks) showing cash outflows” Discuss.

<b>Course Code</b>	:	<b>MCSL-036</b>
<b>Course Title</b>	:	<b>Lab course for OOAD, S/E and Accountancy &amp; Financial Management</b>
<b>Assignment Number</b>	:	<b>MCA(III)/L036/Assignment/2020-21</b>
<b>Maximum Marks</b>	:	<b>100</b>
<b>Weightage</b>	:	<b>25%</b>
<b>Last Dates for Submission</b>	:	<b>31<sup>st</sup> October, 2020 (For July, 2020 Session)</b>
	:	<b>15<sup>th</sup> April, 2021 (For January, 2021 Session)</b>

**Note: 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 Vive voce.**

### **Section A: Object Oriented Analysis and Design**

**Q1. A Software company wants to develop taxi booking app having the following features :**

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

Do the following tasks:

- |  |                  |
|--|------------------|
| (1) Draw an use case diagram                 | <b>(2 Marks)</b> |
| (2) Define all classes and the class diagram | <b>(4 Marks)</b> |
| (3) Draw a simple object model               | <b>(4 Marks)</b> |
| (4) Draw a state transition diagram          | <b>(3 Marks)</b> |

### **Section B: MCS-34: Software Engineering**

**Q2. For the cab booking app problem discussed in a section A do the following tasks:**

- |   |                  |
|---|------------------|
| (1) Develop SRS   | <b>(4 Marks)</b> |
| (1) Draw Data Flow Diagrams (Level 0 and Level 1)         | <b>(4 Marks)</b> |
| (2) Draw an E-R diagram and its related normalized tables | <b>(5 Marks)</b> |

### Section C: MCS-035: Accountancy and financial Management

**Q3.** Post the following transactions of a software development company to prepare (14 Marks) the journal, ledger and trial balance

March 2020	Transaction	Amount
5th March	Started business with cash	4,50000.00
10 March	Deposited In the bank	1,00000.00
15 March	Purchased computers on credit	2,00000.00
18 March	Purchased s/w and peripheral devices on credit	1,30000.00
20 March	Purchase Furniture for cash	60,000.00
22 March	Sold s/w for cash	90,000.00
25 March	Sold s/w on credit	55,000.00
27 March	Paid salary to staff	60,000.00
31 March	Paid rent	40,000.00