

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

**MCA/ASSIGN/SEMESTER-III**

**ASSIGNMENTS**

**(July - 2023 Onwards)**

**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.

**Course Code** : **MCS-031**  
**Course Title** : **Design and Analysis of Algorithms**  
**Assignment Number** : **MCA(III)031/Assignment**  
**Maximum Marks** : **100**  
**Weightage** : **30%**  
**Last Date of Submission** : **15<sup>th</sup> October (For July Session)**  
**15<sup>th</sup> April (For January session)**

**This assignment has 10 questions of 8 Marks each, answer all questions. Rest 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:** For a problem P, two algorithms A and B have time complexities  $T1(n) = 5n^2$  and  $T2(n) = 100n \log n$  respectively. Find the range for n, the size of instance of the given problem P, for which A is more efficient than B. **(8 Marks)**

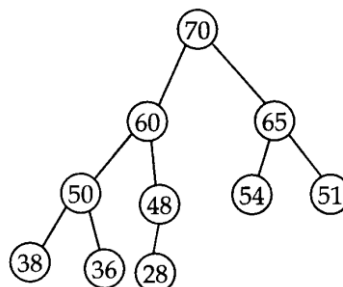
**Q2:** Solve the following recurrence equations: **(8 Marks)**

(i)  $T(n) = 2T(n/2) + O(n)$

(ii)  $T(n) = T(n - 1) + O(n)$

**Q3:** Write a recursive function in C language to calculate the sum of all digits in a long integer provided as input. **(8 Marks)**

**Q4:** Show stepwise sorting of elements using Heapsort algorithm to the following max heap. **(8 Marks)**

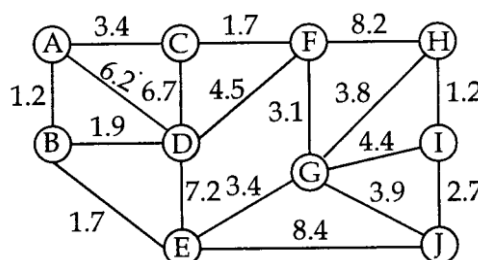


**Q5:** Write a Turing machine to recognize the language of all strings of even length over the alphabet {a, b}. **(8 Marks)**

**Q6:** Define ambiguity in Context-Free Grammar (CFG). Prove that the following grammar is ambiguous. **(8 Marks)**

$$E \rightarrow E+E/E^*E/a$$

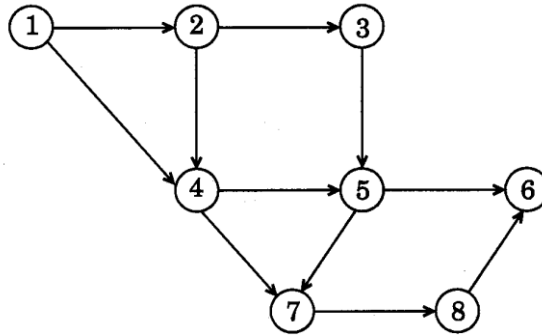
**Q7:** Use Prim's algorithm to construct a minimum spanning tree for the following graph. (use starting node A). **(8 Marks)**



**Q8:** Discuss the relationship between class P, NP, NP complete and NP Hard problems with suitable example of each class. **(8 Marks)**

**Q9:** Define fractional Knap-Sack problem, and give a greedy algorithm to solve this problem efficiently. **(8 Marks)**

**Q10:** Give an algorithm for topological sort. Obtain a topological ordering for the following graph: **(8 Marks)**



|                                |   |   |
|--------------------------------|---|---|
| <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</b>   |
| <b>Maximum Marks</b>           | : | <b>100</b>  |
| <b>Weightage</b>               | : | <b>25%</b>  |
| <b>Last Date of Submission</b> | : | <b>15<sup>th</sup> October (For July Session)</b><br><b>15<sup>th</sup> April (For January Session)</b> |

**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 advantages of Object Oriented Systems. **(10 Marks)**
- Q2:** What is UML? What are types of UML diagrams? Draw class diagram for Online Examination System. Make necessary assumptions. **(10 Marks)**
- Q3:** What is Use Case diagram? Draw Use Case Diagram for Online Shopping System. Make necessary assumptions. **(10 Marks)**
- Q4:** Draw state chart diagram for Online Examination System. Make necessary assumptions. **(10 Marks)**
- Q5: (a)** What is aggregation? Example using suitable example. **(5 Marks)**
- Q5: (b)** What is Sequence Diagram? Draw Sequence Diagram for cash withdrawal from an ATM system. **(5 Marks)**
- Q6:** What is object model? Which diagrams are used in Object model? How Object model is different from dynamic model? Explain in detail. **(10 Marks)**
- Q7:** Draw a DFD for Online Shopping System. Make necessary assumptions. **(10 Marks)**
- Q8:** Write short note on followings (minimum in 250 words) **(10 Marks)**
- i) Inheritance
  - ii) Concurrency Control
  - iii) Deployment Diagram
  - iv) Integrity Constraints

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

Answer all the questions in the assignment which carry 80 marks in total. 20 marks are for viva voce. You may use illustrations. Please 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 with the help of a suitable example. (5 Marks)
- 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 help of examples which can be solved through Divide and Conquer technique and Show its recurrence relation. (10 Marks)
- (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 algorithm when n is a power of 2. (5 Marks)
- Q5:** a) Find a recurrence relation and initial conditions for 4,14,44,134, 404, ... (5 Marks)  
b) Find the generating function of 2, 4, 8, 16, 32, ...
- Q6:** Prove the followings: (16 Marks)
- a) the sum of the degrees of the vertices of G is twice the number of edges  
b) 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  
c) A connected graph G is Eulerian **if and only if** the degree of each of its vertices is even.  
d) 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)
- a) Show that for a subgraph H of a graph G,  $\Delta(H) \leq \Delta(G)$   
b) 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) Is every subgraph of a regular graph regular ? Justify. (3 Marks)  
(c) Construct a 5-regular graph on 10 vertices. (3 Marks)
- Q10:** Verify, "If an undirected graph has exactly two vertices of odd degree there must be a path joining these two vertices." (5 Marks)

|                                  |   |   |
|----------------------------------|---|---|
| <b>Course Code</b>               | : | <b>MCS-034</b>  |
| <b>Course Title</b>              | : | <b>Software Engineering</b>   |
| <b>Assignment Number</b>         | : | <b>MCA(III)/034/Assignment</b>  |
| <b>Maximum Marks</b>             | : | <b>100</b>  |
| <b>Weightage</b>                 | : | <b>25%</b>  |
| <b>Last Dates for Submission</b> | : | <b>15<sup>th</sup> October (For July Session)</b><br><b>15<sup>th</sup> April (For January 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 Grade Card Generation System (OGCGS)**. **OGCGS** will have all fields such as Enrollment Number, Name of Student, Programme Code, Programme Title, Course Codes, e-mail address, Mobile Number etc. You need to include more than 10 courses in the database so that the Grade Card will have marks of all the Courses. You need not limit yourself to the fields listed above. You can add more or reduce depending on the assumptions you make. There should be provision for generation of reports. Make necessary assumptions.

For developing **OGCGS** 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>  |

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

**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:** Explain the scope of Accounting and discuss how it act as an Information System. Also, explain the nature of accounting function and describe the organisation for accounting and finance. **(16 Marks)**
- Q2:** Explain accounting equation and broad categories of accounts in detail. **(16 Marks)**
- Q3: (a)** Explain the operating cycle concept and discuss the factors influencing working capital requirement. **(8 Marks)**
- Q3: (b)** Explain the Principles of financial management and describe the objectives of financial management. **(8 Marks)**
- Q4: (a)** Explain different ratios and indexes used in inventory control. **(8 Marks)**
- Q4: (b)** Explain preparation of Fund Flow Statement with and example. **(8 Marks)**
- Q5:** Write short note on followings: **(16 Marks)**
- Receivables Management
  - Accounting Rate of Return Method
  - Characteristics of Current Assets
  - Cash Forecasting and Budgeting



|                                  |   |   |
|----------------------------------|---|---|
| <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</b>   |
| <b>Maximum Marks</b>             | : | <b>100</b>  |
| <b>Weightage</b>                 | : | <b>25%</b>  |
| <b>Last Dates for Submission</b> | : | <b>15<sup>th</sup> October (For July Session)<br/>15<sup>th</sup> April (For January Session)</b> |

**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:** Online admission portal features include the ability to register by entering all of the applicant's information, apply for various university programmes, check the status of admission, and generate reports. It also accepts credit/debit card payments online and allows users to submit online queries. A prospective student can easily submit an application for admission online. The system produces the user name and password for existing users' verification and authentication as the admission is being filled out. You must follow these instructions: (make necessary assumption state it)

- (a) Draw the use case diagram. **(5 Marks)**
- (b) Define all the classes and draw the class diagram. **(5 Marks)**
- (c) Draw the sequence and collaboration diagrams. **(3 Marks)**

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

**Q2:** For the Online admission app problem discussed in a section A do the following tasks:

- a) Develop SRS. **(5 Marks)**
- b) Draw Data Flow Diagrams (Level 0 and Level 1) **(5 Marks)**
- c) Draw an E-R diagram and its related normalized tables. **(3 Marks)**

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

**Q3:** Post the following transactions of a medical company to prepare the journal, ledger and trial balance:

**(14 Marks)**

| July 2023             | Transaction   | Amount     |
|-----------------------|---|------------|
| 5 <sup>th</sup> July  | Started business with cash                          | 1,50000.00 |
| 10 <sup>th</sup> July | Deposited in the bank                               | 30,000.00  |
| 15 <sup>th</sup> July | Purchased furniture from distributors on credit     | 60,000.00  |
| 18 <sup>th</sup> July | Purchased medical equipment on cash                 | 60,000.00  |
| 20 <sup>th</sup> July | Purchase Computer and other related items with cash | 75,000.00  |
| 22 <sup>nd</sup> July | Sold medicines for cash                             | 45,000.00  |
| 25 <sup>th</sup> July | Sold medicine on credit                             | 60,000.00  |
| 27 <sup>th</sup> July | Paid salary to staff                                | 35,000.00  |
| 31 <sup>st</sup> July | Paid rent   | 25,000.00  |