

MASTER OF COMPUTER APPLICATIONS

(MCA)

MCA/ASSIGN/III/YEAR/2014

**ASSIGNMENTS
Year, 2014-15**

(3rd Semester)

(MCS-031, MCS-032, MCS-033, MCS-034, MCS-035, MCSL-36)



**SCHOOL OF COMPUTER AND INFORMATION SCIENCES
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Course Code	:	MCS-031
Course Title	:	Design and Analysis of Algorithms
Assignment Number	:	MCA (3)/031/Assign/2014-15
Maximum Marks	:	100
Weightage	:	25%
Last Dates for Submission	:	15 th October, 2014 (For July 2014 Session) 15 th April, 2015 (For January 2015 Session)

There are seven 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

In response to the questions given in the assignment, illustrations and examples should be different from those given in the course material.

Q.1. a) Discuss briefly the five essential attributes of an algorithm. (3 marks)

b) Write a recursive procedure for the product of first n natural numbers. (2 marks)

Then explain how your algorithm computes product of first 6 natural numbers.

c) Arrange the following growth rates in increasing order: (2 marks)
 $O(n(\log n)^2)$, $O((35)^n)$, $O(35n^2 + 11)$, $O(1)$, $O(n \log n)$

d) In respect of understanding a problem for solving it using a computer, explain ‘analysing the problem’ step. (3 marks)

Q.2. Suppose that instead of binary or decimal representation of integers, we have a representation using 5 digits, viz. 0,1,2,3,4, along with 5’s complement, representation of integers. For example, the **integer 147** is represented as **(01042)₅ = (in decimal) + 1. 5³ + 0. 5² + 4. 5¹ + 2. 3⁰**, where the leading zero indicates positive sign. (10 marks)

And the **integer (- 147) in 5’s complement is represented by 13403**, the leading 1 indicates negative sign. The other digits, except the right-most, in the representation of (- 147) are obtained by subtracting from 4 the corresponding digit in 147’s representation, and then adding 1 (the representation of -147 is obtained as 13402 + 00001).

Write a program for the arithmetic (negation of an integer, addition, subtraction and multiplication of two integers) of integers using 5’s complement representation. The program should include a procedure for calculating each of negation of an integer, addition,

subtraction and multiplication of two integers. The integers will use 8 5-digit positions, in which the left-most position will be used for sign.

Using your program find the 5-digit representation of each of the decimal numbers/ expression: 345, -297 , 18 and $((345 - 297) * 18)$

Q.3. a) Write a short note on each of the following: (4 marks)

- i) Best case analysis
- ii) amortized analysis

b) Using one-by-one (i) insertion sort (ii) heap sort and (iii) merge sort, sort the following sequence in increasing order and analyze (i.e., find number of comparisons and assignments in each of) the algorithm:
84, 35, 47, 18, 82, 17, 56, 40, 12, 67 (6 marks)

Q.4. a) The following pseudo-code is given to compute $(a^b) \bmod n$, where a, b and n are positive integers. Trace the algorithm to compute $11^{362} \bmod 561$ (5 marks)

MODULAR-EXPONENTION (a, b, n)

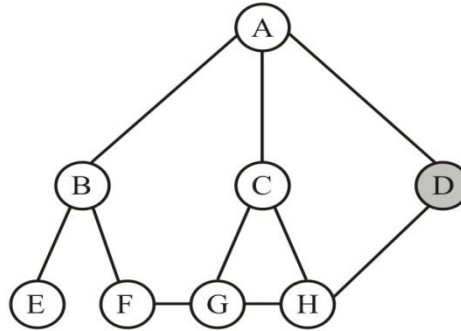
Let $(b_k, b_{k-1}, \dots, b_0)$ be binary representation of b, in which $b_k=1$

1. $d \leftarrow a$; d stores partial results of $(a^b) \bmod n$
2. for $i \leftarrow (k-1)$ downto 0
3. do
4. $d \leftarrow (d \cdot d) \bmod n$
5. if $b_i = 1$
6. $d \leftarrow (d \cdot a) \bmod n$
7. end-do
8. return d.

Note: The above algorithm is a sort of implementation of the ideas explained in Section 1.9 of Block2 of MCS- 031, and should be learned along with Section 1.9.

b) Explain the essential idea of Dynamic Programming. How does Dynamic Programming differ from Divide and conquer approach for solving problems? (5 marks)

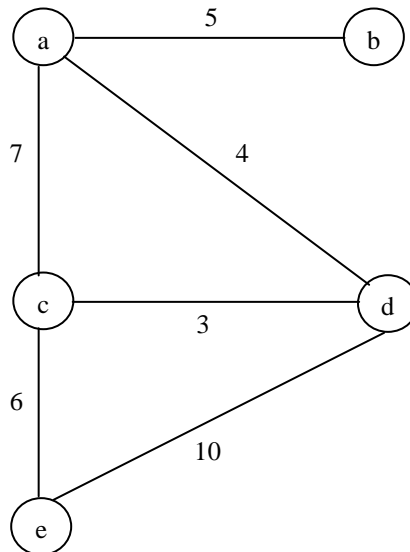
- Q.5.** a) For the graph given in Figure below, use (i) BFS (ii)DFS to visit various vertices. The vertex B is taken as the starting vertex and, if there are more than one vertices adjacent to a vertex, then the adjacent vertices are visited in lexicographic order. (6 marks)



- b) In context of graph search, explain the minimax principle. (4 marks)

- Q.6.** a) Is there a greedy algorithm for every interesting optimization problems? Justify your Claim. (3 marks)

- b) Apply each of (i) Prim's and (ii)Kruskal's algorithms one at a time to find minimal spanning tree for the following graph (7 marks)



Q7. Write note on each of the following: (20 marks)

- i)* Unsolvability/ undecidability of a problem
- ii)* Halting problem
- iii)* Reduction of a problem for determining decidability
- iv)* Rice theorem
- v)* Post correspondence problem
- vi)* NP-complete problem
- vii)* K-colourability problem
- viii)* Independent set problem

Course Code : **MCS-032**
Course Title : **Object Oriented Analysis and Design**
Assignment Number : **MCA(3)/032/Assign/2014-15**
Assignment Marks : **100**
Weightage : **25%**
Last Dates for Submission : **15th October, 2014 (For July 2014 Session)**
15th April, 2015 (For January 2015 Session)

There are **eight questions** in this assignment, **which carry 80 marks. Rest 20 marks are for viva-voce. Answer all the questions.** Make necessary assumptions where ever required. Please go through the guidelines regarding assignments given in the Programme Guide for the format of presentation.

- Question 1:** What is Object Orientated Modeling (OOM)? Explain advantages of OOM over structured modeling. *(10 Marks)*
- Question 2:** What is UML? Briefly explain use of Use Case Diagram and Sequence Diagram with the help of an example of each. *(10 Marks)*
- Question 3:** Draw a DFD for Library Management System. *(10 Marks)*
- Question 4:** What is an instance diagram? Draw an instance diagram for the arithmetic expression:
 $A = (B + C * D) / (B - C + D)$. *(10 Marks)*
- Question 5:** What are different types of Object Oriented models? Explain the types of characteristics represented by these models. *(10 Marks)*
- Question 6:** What is state diagram? Explain its advantages. Draw state diagram for Railway Ticket Booking on IRCTC website. *(10 Marks)*
- Question 7:** What is need of concurrency management in Object Oriented Systems? Explain the important issues related to concurrency management with the help of an example. *(10 Marks)*
- Question 8:** What is association in UML Diagram? Briefly explain different types of associations available in UML. Also explain the process of mapping a ternary association into database table. *(10 Marks)*

Course Code : MCS-033
Course Title : Advanced Discrete Mathematics
Assignment Number : MCA(3)/033/Assign/2014-15
Maximum Marks : 100
Weightage : 25%
Last Dates for Submission : 15th October, 2014 (For July 2014 Session)
15th April, 2015 (For January 2015 Session)

There are FIVE questions of total 80 marks in this assignment. Answer all questions. 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.

Note: In response to the questions given in the assignment, illustrations and examples should be different from those given in the course material.

Q.1. Define each of the following concepts from graph theory and give one suitable example for the concept: (24 marks)

- | | |
|--------------------------|-------------------------------------|
| i) Complete graph | ii) Path |
| iii) Cycle | iv) Subgraph |
| v) Complement of a graph | vi) Connected components of a graph |
| vii) Bipartite | viii) Spanning |
| ix) Vertex cut-set | x) Eulerian circuit |
| xi) Eulerian graph | xii) Hamiltonian graph |
| xiii) Open trail | xiv) Edge traceable graph |
| xv) Bipartite graph | |

Q.2. A person deposits Rs. 250, 000/- in a bank in a saving bank account at a rate of 8 % per annum. Let P_n be the amount payable after n years, set up a recurrence relation to model the problem. Also using the recurrence relation, find amount payable after 9 years. (7 marks)

Q.3. For each of the following recurrences, find its order and degree and also tell whether it is homogeneous or non-homogeneous (7 marks)

- i) $a_n = a_{n-1} + a_{n-2} + \dots + a_0$
- ii) $a_n = na_{n-2} + 2^n$
- iii) $a_n = \sqrt{a_{n-1} + (a_{n-2})^2}$

iv) $a_n = (a_{n-1})^2 + a_{n-2} a_{n-3} a_{n-4}$

v) $a_n = \sin a_{n-1} + \cos a_{n-2} + \sin a_{n-3} + \dots + a_n$

vi) $b_n = b_{n-1} + (n + 3)$

vii) $a_n = a_{n-1} a_1 + a_{n-2} a_2 + \dots + a_1 a_{n-1}$ (for $n \geq 2$)

Q.4. The following recurrence equation represents the Tower of Hanoi problem: (7 marks)

$C_n = 2 C_{n-1} + 1$ (for $n \geq 2$) and $C_1 = 1$

Verify, using Principle of Mathematical Induction that $C_n = 2^n - 1$.

Q.5. Find generating function for each of the following sequences: (7 marks)

i) (4, 12, 36, 108, 384,)

ii) $(1, 5k(k+1)/2, 25k(k+1)(k+2)/6, 125k(k+1)(k+2)(k+3)/24, \dots)$

Q.6. Find the sequence with each of the following functions as its exponential generating function: (7 marks)

i) $f(x) = 5x^{3x}$

ii) $f(x) = (2 - x) + e^{3x}$

Q.7. What is the solution of the recurrence relation (7 marks)

$a_n = 2a_{n-1} + 3a_{n-2}$

with $a_0 = 5$ and $a_1 = 8$?

Q.8. Find all solutions of the recurrence relation $a_n = 5 a_{n-1} + 3n$. What is the solution with $a_1 = 9$? (7 marks)

Q.9. Find all solutions of the recurrence relation (7 marks)

$a_n = 5a_{n-1} - 6a_{n-2} + 7^n$

Course Code	:	MCS-034
Course Title	:	Software Engineering
Assignment Number	:	MCA(3)/034/Assign/2014-15
Maximum Marks	:	100
Weightage	:	25%
Last Dates for Submission	:	15th October, 2014 (For July 2014 Session) 15th April, 2015 (For January 2015 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.

Question 1: Assume that you are assigned responsibility of developing an **Online Admission System (OAS)**. **OAS** is for applicants for admission to various programmes of IGNOU. **OAS** will have admission form. The applicant's have to fill the form, upload photograph and scanned versions of qualifying examination certificates for consideration for admission. On submission of online admission form, **OAS** should check the data filled in the form and allot study centers as per choice exercised by the student in admission form if the applicant is eligible for admission. Make necessary assumptions.

For developing **OAS** 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. *(20 marks)*

Course Code : **MCS-035**
Course Title : **Accountancy and Financial Management**
Assignment Number : **MCA (3)/035/Assign/2014-15**
Maximum Marks : **100**
Weightage : **25%**
Last Dates for Submission : **15th October, 2014 (For July 2014 Session)**
15th April, 2015 (For January 2015 Session)

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.

Question 1 Explain the role of Ratio Analysis in the interpretation of financial statements. Examine the limitations of ratio analysis. *(10 Marks)*

Question 2 Critically examine the various methods of evaluation of Capital Budgeting Proposals. Discuss their advantages and limitations. *(15 Marks)*

Question 3 “Inadequate working capital is disastrous whereas redundant working capital is a criminal waste. Critically examine this statement.” Discuss. *(15 Marks)*

Question 4 Differentiate between:

a) Trial Balance and a Balance sheet *(5 marks)*

b) Profit and Loss Account and a Balance Sheet. *(5 marks)*

Question 5 Following are the balance sheets of a limited company as on 31st December, 2012 and 2013. *(30 marks)*

Liabilities	2012 Rs.	2013 Rs.	Assets	2012 Rs.	2013 Rs.
Share Capital	54,000	70,000	Plant	35000	43,000
P & L A/c	8600	8800	Building	50950	48000
Creditors	28,000	24,000	Stock	25500	18800
Bills payable	8,000	8500	Debtors	22,000	16,200
Bank	25000	Goodwill	3,000	2520
Loan(Long term)	13,000	15,500	Bank	2100
Reserve			Cash	150	180
	1,36,600	1,30,800		1,36,600	1,30,800

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

- a)* Dividends of Rs 6,000 were paid during the year.
- b)* Rs. 3600 was written off as depreciation on plant and Rs. 2950 on Building.
- c)* Profit on sale of Plant was Rs. 3000.

Course Code	:	MCSL-036
Course Title	:	Laboratory Course (For Object Oriented Analysis and Design, Software Engineering and Accountancy and Financial Management
Assignment Number	:	MCA (3)/036L/Assign/2014-15
Maximum Marks	:	100
Weightage	:	25%
Last Dates for Submission	:	31st October, 2014 (For July 2014 Session) 30th April, 2015 (For January 2015 Session)

This assignment has three sections. Answer all the questions in each section. Section 1 and Section 2 are of 13 marks each. The lab records related to these sections also carries 13 marks each. Section 3 and lab records related to Section 3 carry 14 marks each. 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.

SECTION 1: MCS-032

Question 1: A Bank has many customers. Most of its customers have a saving accounts with the Bank. Customers can take loan from the Bank which is to be paid back in installments (EMIs). A customer needs to keep a minimum balance in the Bank and is allowed to perform transactions like deposit money in cash or cheque, withdraw money and transfer funds. The bank gives interest to the account holders.

- i)* Draw at least two use case diagrams and define all the classes. *(2 marks)*
- ii)* Draw the Sequence and Collaboration Diagrams. *(3 marks)*
- iii)* Draw the Class Diagrams. *(3 marks)*
- iv)* Draw the State Transition Diagram. *(3 marks)*
- v)* Draw the Component Deployment Model. *(2 marks)*

SECTION 2: MCS-034

Question 1: Do the following tasks for the computerization of a petrol pump shop in maintaining daily sales of Petrol, Diesel, Coolant and other products and purchase of these products from an oil company. The shop also maintains the records of sales and service staff.

- i)* Develop the SRS by performing requirements study. *(2 marks)*
- ii)* Identify various processes of the system and generate the DFD's for the system. *(2 marks)*
You may use any software to develop the DFD.
- iii)* Design an ER diagram for the company and do the database design giving all the constraints. *(3 marks)*
- iv)* Perform the detailed procedural design for any two processes. *(2 marks)*
- v)* Create at least four test cases for each of the procedures designed in part (iv) *(2 marks)*
- vi)* Suggest some security mechanism for the usage of the system with various privileges. *(2 marks)*

SECTION 3: MCS-035

Question 1: Pass the following transactions of hospital to prepare journal and trial balances. *(14 marks)*

Sept 2008	Transactions	Rs.
4	Started the hospital business with cash	3,50,000
8	Deposited in the Bank	1,00,000
12	Equipments purchased for hospital	2,00,000
16	Drugs purchased for hospital	1,00,000
20	Received amount from patients	2,00,000
25	Paid Salary	2,00,000
30	Paid Rent	60,000