

MASTER OF COMPUTER APPLICATIONS

(MCA)

MCA/ASSIGN/III/YEAR/2013

**ASSIGNMENTS
Year, 2013-14**

(3rd Semester)

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



**SCHOOL OF COMPUTER AND INFORMATION SCIENCES
INDIRA GANDHI NATIONAL OPEN UNIVERSITY
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Course Code : **MCS-031**
Course Title : **Design and Analysis of Algorithms**
Assignment Number : **MCA (3)/031/Assign/13**
Maximum Marks : **100**
Weightage : **25%**
Last Dates for Submission : **15th October, 2013 (For July 2013 Session)**
15th April, 2014 (For January 2014 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.

Question 1:

- (a) Show, through appropriate examples or otherwise, that the following three characteristics of an algorithm are independent of each other: (*i.e.*, a method may have one of these properties, without having the other two) (3 marks)
- (i) finiteness (ii) definiteness (iii) effectiveness
- (b) Let $f(n)$ denote the n th term of a sequence of integers given by the equation $f(n) = f(n-1) + f(n-2)$ for $n > 2$ and $f(1) = 1$ and $f(2) = 1$, then using principle of mathematical induction, show that $\sqrt{5} f(n) = \{(1 + \sqrt{5}) / 2\}^n - \{(1 - \sqrt{5}) / 2\}^n$ for all $n \geq 1$ (5 marks)
- (c) Arrange the following growth rates in increasing order: (2 marks)
- $O((24)^n)$, $O(n^2)$, $O(1)$, $O(n \log n)$

Question 2:

(10 marks)

Suppose that instead of binary or decimal representation of integers, we have ternary, along with 3's complement, representation of integers, i.e., integers are represented using three digits, viz., 0, 1, 2. For example, the integer 47 is represented as **01202 = (in decimal) $1 \cdot 3^3 + 2 \cdot 3^2 + 0 \cdot 3^1 + 2 \cdot 3^0$** , where, the leading zero indicates positive sign. And the integer (-47) in 3's complement is represented by **11021**, the leading 1 indicates negative sign. The other digits, except the right-most, in the representation of (-47) are obtained by subtracting from 2 the corresponding digit in 47's representation, and then adding 1 (the representation of -47 is obtained as $11020 + 00001$).

Write a program for the arithmetic (negation of an integer, addition, subtraction and multiplication of two integers) of

integers using 3'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-ternary digit positions, in which the left-most position will be used for sign.

Using your program find the ternary representation of each of the decimal numbers 345, -- 297, 18 and $(345 - 297) * 18$

Question 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) bubble sort (ii) heap sort and **(6 marks)**
 (iii) quick sort, sort the following sequence in increasing order and analyze (i.e., find number of comparisons and assignments in each of) the algorithm: 43, 28, 37, 18, 15, 40, 12

Question 4:

- (a) The following pseudo-code is given to compute $(a^b) \bmod n$, **(5 marks)**
 where a, b and n are positive integers. Trace the algorithm to compute $7^{560} \bmod 561$

MODULAR-EXPONENTION (a, b, n)

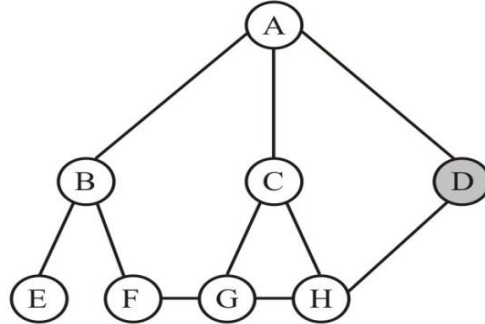
1. $c \leftarrow 0$ { variable c is assigned 0 }
2. $d \leftarrow 1$
3. *let $(b_k, b_{k-1}, \dots, b_0)$ be binary representation of b*
4. for $i \leftarrow k$ downto 0
5. do $c \leftarrow 2c$
6. $d \leftarrow (d \cdot d) \bmod n$
7. if $b_i = 1$
8. then $c \leftarrow c+1$
9. $d \leftarrow (d \cdot a) \bmod n$
10. end-do
11. 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 **(5 marks)**
 does Dynamic Programming differ from Divide and conquer approach for solving problems?

Question 5:

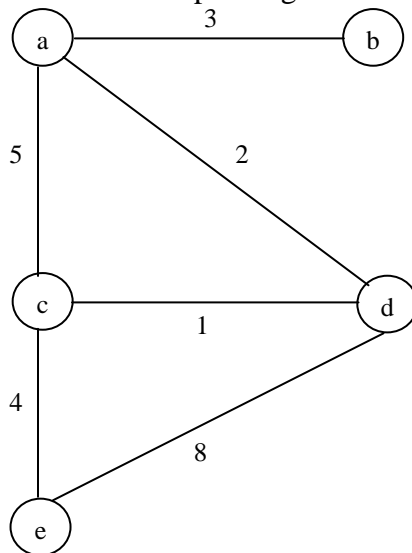
- (a) For the graph given in Figure below, use DFS to visit various vertices. The vertex B is taken as the starting vertex and, if there are more than one vertices adjacent to a vertex, then the adjacent vertices are visited in lexicographic order. **(5 marks)**



- (b) In context of graph search, explain the minimax principle. **(5 marks)**

Question 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)**



Question 7: 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/13**
Assignment Marks : **100**
Weightage : **25%**
Last Dates for Submission : **15th October, 2013 (For July 2013 Session)**
15th April, 2014 (For January 2014 Session)

There are **seven 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 Orientation? Explain the concept of class, objects, instance, generalization, and associations . **(10 Marks)**
- Question 2 :** What is UML? Briefly explain different UML diagrams. **(10 Marks)**
- Question 3 :** Draw a DFD for Bank Accounts Management System. **(10 Marks)**
- Question 4 :** What is specialization ? Explain how it is different from generalisation with the help of an example. **(10 Marks)**
- Question 5 :** What is Object Oriented modeling? Explain different types of model and their requirement in system design. **(10 Marks)**
- Question 6 :** (a) Explain the two strategies to implement state charts with the help of an example of each. **(8 Marks)**
- (b) Draw a sequence diagram for sending a audio and a video file to your friend using e-mail to your friend. **(7 Marks)**
- Question 7 :** (a) What is Bi-directional Implementation? Explain advantages of Bi-directional Implementation with the help of an example. **(10 Marks)**
- (b) How do you identify concurrency? Explain the important issues related to concurrency. **(5 Marks)**

Course Code : MCS-033
Course Title : Advanced Discrete Mathematics
Assignment Number : MCA(3)/033/Assign/13
Maximum Marks : 100
Weightage : 25%
Last Dates for Submission : 15th October, 2013 (For July 2013 Session)
15th April, 2014 (For January 2014 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.

Question 1: (7 marks)

A person deposits Rs. 10, 000/- in a bank in a saving bank account at a rate of 5% 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 7 years.

Question 2: (7 marks)

We are given a recurrence relation $a_n = 6a_{n-1} - 9a_{n-2}$, where $a_0 = 1$ and $a_1 = 6$. Verify, using Principle of Mathematical Induction that $a_n = 3^n + n3^n$

Question 3: (7 marks)

For each of the following recurrences find, its order and degree and also tell whether it is homogeneous or non-homogeneous

- (i) $a_n = a_{n-1} + a_{n-3}$.
- (ii) $b_n = b_{n-1} + (n + 3)$
- (iii) $a_n = a_{n-1}a_1 + a_{n-2}a_2 + \dots + a_1a_{n-1}$ (for $n \geq 2$)

Question 4: (7 marks)

Find generating function for each of the following sequences:

- (i) 1, 1, 1, 1, 1,
- (ii) $a_k = (k + 1)$ for $k = 0, 1, 2, 3, \dots$

Question 5: (7 marks)

Find the sequence with each of the following functions as its exponential generating function:

- (i) $f(x) = 3x^{2x}$
- (ii) $f(x) = (1 - x) + e^{-2x}$

Question 6: (7 marks)

What is the solution of the recurrence relation
 $a_n = a_{n-1} + 2a_{n-2}$ with $a_0 = 2$ and $a_1 = 7$?

Question 7: (7 marks)

Find all solutions of the recurrence relation $a_n = 3a_{n-1} + 2n$.
What is the solution with $a_1 = 3$?

Question 8: (7 marks)

Find all solutions of the recurrence relation
 $a_n = 5a_{n-1} - 6a_{n-2} + 7^n$

Question 9: (24 marks)

Define each of the following concepts from graph theory and
give one suitable example for the concept:

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

Course Code : **MCS-034**
Course Title : **Software Engineering**
Assignment Number : **MCA(3)/034/Assign/13**
Maximum Marks : **100**
Weightage : **25%**
Last Dates for Submission : **15th October, 2013 (For July 2013 Session)**
15th April, 2014 (For January 2014 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 a **Web based Examination Form Submission and Processing System (WEFSPS)**. WEFSPS accepts data from the learners as well as staff of RC who receive paper based examination forms. After the last date for submission of form is completed, WEFSPS should generate hall tickets for the applicants. However, it needs to check the registration validity, fee payment status and then generated hall ticket. The candidate should be assigned examination center that is nearest to his/her residence.

For developing **WEFSPS** 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/2013
Maximum Marks : 100
Weightage : 25%
Last Dates for Submission : 15th October, 2013 (For July 2013 Session)
 15th April, 2014 (For January 2014 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: (10 Marks)

Assuming the current ratio is 2, state in each of these cases, whether the ratio will improve or decline or will have no change:

- (i) Purchase of fixed assets
- (ii) Cash collected from customers
- (iii) Bills receivable dishonoured
- (iv) Issue of new shares
- (v) Payment of a current liability

Question 2: (10 Marks)

“For most investment decisions that a firm faces, NPV is either a superior decision criterion, or is at least as good as the competing techniques.” In what investment situation is the profitability index better than the NPV ?

Question 3: (10 Marks)

“Efficient cash management will aim at maximising the cash inflows and showing cash outflows.” Discuss.

Question 4: (30 Marks)

M/S Ram & Sons has extracted the following trial balance from its books on 31st March, 2012

<i>Particulars</i>	<i>Amount Rs.(Dr.)</i>	<i>Amount Rs.(Cr.)</i>
Drawings	15,000	---
Cash	6,760	---
Petty Cash	1000	---
Leasehold Land	20,000	---

Opening Stock (at market value)	55,000	
Salary	12,000	
Sundry Debtors	50,000	
Wages	40,000	---
Bank	21,000	---
Capital	---	33,000
Rent	8000	---
Electricity	6,000	---
Motor Car	10,240	---
Advertising	9,000	---
Sundry Creditors	---	40,000
Purchases	3,00,000	---
Postage and Telephone	3,000	---
Sales	---	5,00,000
Discounts	11,400	---
General Charges	5,000	---
Petty Cash Expenses	9,600	---
Suspense	---	10,000
Total	5,83,000	5,83,000

You are required to prepare a Trading and Profit and Loss Account and a Balance Sheet using the following additional information:

- 1) Closing Stock at market value as on 31st March, 1982 was Rs.80, 000/- (cost Rs.75, 000/-). Stock is being valued on a consistent basis of cost or market price whichever is lower.
- 2) The petty cash balance represents the month-end imprest account. As on the closing date the Petty Cashier has vouchers totalling to Rs.400/- for which he had not received reimbursement from the main cashier.
- 3) Discount allowed amounting to Rs.1, 000 had been posted to the debit of sundry debtors.
- 4) Cash withdrawn from bank Rs.4000/- had not been entered in the bank column of the Cash Book.
- 5) Sales Account had been under cast by Rs.4,000/-

- 6) Leasehold land was purchased during the year. On the date of purchase the unexpired period of the lease was five years.
- 7) No entry had been passed in the books for stock withdrawn from the business by the proprietor valued at Rs.10,000/-
- 8) Advertising includes cost of a campaign done during the year Rs. 6, 000/-. It is expected that the effect of the campaign will be felt for at least three years.
- 9) Telephone bills amounting to Rs.1, 000 remained unpaid.

Question 5:

(20 Marks)

Following are the balance sheets of a limited company as on 31st December, 2011 and 2012.

Liabilities	2011 Rs.	2012 Rs.	Assets	2011 Rs.	2012 Rs.
Share Capital	6,00,000	8,00,000	Machine at cost	4,00,000	6,45,000
Debentures	2,00,000	3,00,000	Building at cost	3,00,000	4,00,000
P & L A/c	1,25,000	2,50,000	Stock	3,00,000	3,50,000
Creditors	1,15,000	90,000	Debtors	69,000	61,000
Provision For bad & doubtful debts:	6,000	3,000	Preliminary Exp.	7,000	6,000
Provision For Depreciation:			Bank	20,000	40,000
Building	20,000	24,000			
Machine	30,000	35,000			
	10,96,000	15,02,000		10,96,000	15,02,000

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 50,000 were paid during the year.
- (b) During the year a part of the machine costing Rs. 70,000(accumulated depreciation thereon Rs. 2000) was sold for Rs. 6000

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/2013
Maximum Marks	:	100
Weightage	:	25%
Last Dates for Submission	:	31st October, 2013 (For July 2013 Session) 30th April, 2014 (For January 2014 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:

The teacher conducts on-line classes to teach computer science courses to distance education students. The teacher uploads a problem in the web portal. Students are required to register for these courses in the beginning of the session. Students work on a problem, discuss among peer group, ask question to the teacher, using tools like Skype, chat rooms and finally send the solution through e-mail attachment. The teacher then grades the solution and uploads the grading sheet. Grading sheet of each student is password protected opened by the respective student.

- i) Draw at least two 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 simple diary and dispatch system. It maintains incoming and outgoing letters/documents/circulars and also whom it has been distributed for taking necessary actions. The system should generate weekly reports of pending files received, dispatched and complete status of records.

- 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. You may use any software to develop the DFD. **(2 marks)**
- 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: **(14 marks)**

Pass the following transactions of hospital to prepare journal and trial balances

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