MASTER OF COMPUTER APPLICATIONS (MCA)

MCA/ASSIGN/SEMESTER-IV

ASSIGNMENTS

(July - 2023 Onwards)

MCS-041, MCS-042, MCS-043, MCSP-044, MCSL-045

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.8

Course Code	**:**	**MCS-041**
Course Title	**:**	**Operating Systems**
Assignment Number	**:**	**MCA(IV)/041/Assignment**
Maximum Marks	**:**	**100**
Weightage	**:**	**25%**
Last Date of Submission	**:**	**15th October (For July Session)** **15th April (For January Session)**

This assignment has six questions. 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.

Q1: **(10 Marks)**

Write a monitor solution to the dining philosopher's problem.

Q2: **(10 Marks)**

Consider the following jobs:

Job #	Arrival time	Run time
A	0	2
B	2	4
C	3	5
D	5	6
E	6	4

a) Using the **SJF** method, compute the completion times of the above jobs, average turnaround time and average waiting time.

b) Using the **SRTF** (Shortest Remaining Time first) method, compute the completion times of the above jobs, the average turnaround time and the average waiting time. Note that SRTF is SJF with preemption.

Completion time - arrival time = turnaround time

c) Using the Round Robin method (with Quantum = 3), compute the completion times of the above jobs and the average waiting time.

Q3: **(10 Marks)**

What will be the number of page faults for the algorithms (FIFO, LRU and Optimal) for the following page reference string:

1,2,6,7,2,4,1,7,5,5,3,5,1,2,1,5,7,6,3

for a memory with 4 frames?

Q4: **(10 Marks)**

Write and explain the Banker's algorithm. Consider the following snapshot of a system:

	Allocation				Max				Available			
	A	**B**	**C**	**D**	**A**	**B**	**C**	**D**	**A**	**B**	**C**	**D**
P0	0	0	1	2	0	0	1	2	1	5	2	0
P1	1	0	0	0	1	7	5	0				
P2	1	3	5	4	2	3	5	6				
P3	0	6	3	2	0	6	5	2				
P4	0	0	1	4	0	6	5	6				

Answer the following questions using Banker's algorithm:

i. What is the content of the matrix need?
ii. Is the system in a safe state?
iii. If a request from P1 arrives for (0, 4, 2, 0), can the request be granted immediately?

Q5:

(a) List the security attacks that cannot be prevented by encryption. **(5 Marks)**

(b) Describe why authentication is important for file protection. **(5 Marks)**

(c) Explain the difference between scheduling and allocation of processor resources in a multiprocessor operating system. Identify the counterpart of each, if any, in a uniprocessor operating system. **(10 Marks)**

Q6:

Discuss in detail the Process management, Memory management, I/O & File management and Security and Protection in Windows-11 Operating System. **(20 Marks)**

Course Code	**:**	**MCS-042**
Course Title	**:**	**Data Communication and Computer Network**
Assignment Number	**:**	**MCA(IV)/042/Assignment**
Maximum Marks	**:**	**100**
Weightage	**:**	**25%**
Last Dates for Submission	**:**	**15th October (For July Session)** **15th 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 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 one technique each for *Analog to Digital modulation* and *Digital to Analog modulation* with the help of diagrams. **(6 Marks)**

Q2: **(a)** What are the Basic types of errors during data transmission, explain with the help of an example. **(4 Marks)**

(b) Find CRC for the data polynomial $X^8+X^5+X^3+X^1+1$ with the generator polynomial X^4+X^2+1. **(6 Marks)**

Q3: Explain the concept of Digital-to-Digital encoding. Sketch the Differential Manchester coding and RZ encoding of the following bit stream: **(6 Marks)**

0011 0101

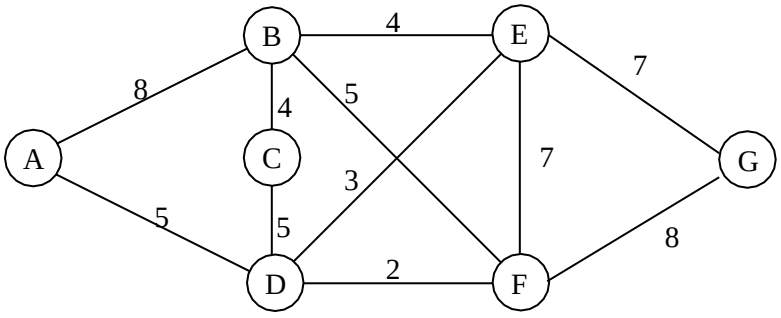
Q4: **(a)** Explain the ALOHA and Slotted ALOHA. Also, derive the expression for computing the throughput for ALOHA and Slotted ALOHA. How does throughout change with load in ALOHA? Explain with the help of a diagram. **(6 Marks)**

(b) Explain different versions of the CSMA protocol. Also, explain the CSMA/CD with the help of diagrams. **(6 Marks)**

Q5: What is the purpose of Routing algorithms? Explain the link state routing algorithm with the help of an example. **(6 Marks)**

Q6: Explain the IEEE 802.11 protocol stack with the help of diagrams. **(6 Marks)**

Q7: Apply Dijkstra's Shortest path algorithm to find the shortest path from a source node A to all the other nodes in a graph given below: **(6 Marks)**



Q8: Explain the TCP segment header with the help of a diagram. Explain the process of TCP connection establishment using a three-way handshake mechanism. Also, explain the TCP flow control with the help of an example. **(10 Marks)**

Q9: **(a)** What are the security considerations of WWW? Discuss the use of SSL and S-HTTP for web security. **(6 Marks)**

(b) Explain the Diffie-Hellman algorithm. Also, explain an example of its use. **(6 Marks)**

(c) Explain how digital signatures are used in the context of network security. What are the uses of digital signatures? **(6 Marks)**

Course Code	**:**	**MCS-043**
Course Title	**:**	**Advanced Database Management Systems**
Assignment Number	**:**	**MCA(IV)/043/Assignment**
Maximum Marks	**:**	**100**
Weightage	**:**	**25%**
Last Dates for Submission	**:**	**15th October (For July Session)** **15th 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. Place go through the guidelines regarding assignments given in the Programme Guide for the format of presentation.

Q1: Design a generalization /specialization hierarchy for a University Admission System. The University has many programmes, each programme has a specific duration. Registration into a programme requires students to register for many subjects of that Programme. The eligible students can take fresh admission or can re-register in the courses by paying the requisite fee.

Justify your placement of attributes at each level of the hierarchy. Convert the diagram into tables with integrity constraints for each table. **(6 Marks)**

Q2: Explain the following with the help of an example. **(6 Marks)**
(a) Stored Procedures and Triggers
(b) Embedded SQL

Q3: Create an XML document for Books using Book ID as an attribute. It should include information about the title of the Book, Author list of the Book, ISBN number of the book, Publisher of the Book, price of the book, year of publication and a brief description of the book. Create the necessary DTD to verify the document. You should show data of at least 3 books.
(6 Marks)

Q4: Explain the multi-valued dependency and Join-Dependency with the help of an example of each. Explain the 4th Normal Form and 5th Normal Form with the help of an example of each.
(8 Marks)

Q5: Explain the term Serializability with the help of an example. Explain the two-phase locking protocol in the context of concurrent transactions. Also, explain the timestamp-based protocols for concurrent transactions. **(6 Marks)**

Q6: Explain the concept of log-based recovery with the help of an example for the deferred database modification scheme. What is a checkpoint? How can it be used in recovery? Explain with the help of an example. **(6 Marks)**

Q7: What is access control in the context of DBMS? What are the different access permissions that can be granted using SQL? Explain with the help of an example of each. Explain the concept of Statistical database security with the help of an example. **(6 Marks)**

Q8: How is the SELECT and JOIN operation can be performed in a DBMS? Explain the Index Scan in the context of the SELECT operation. What is the cost of performing the SELECT operation using Index Scan? Also, write and explain the algorithms for performing a join using Nested-loop join and Block-nested loop join methods. Also, illustrate the computation of the cost of the join operations for Nested loop join with the help of an example. **(10 Marks)**

Q9: Explain the characteristics of a data warehouse. What are the components of a data warehouse? Explain. Also, explain the multi-dimensional data, star schema and snowflake schema in the context of a data warehouse with the help of an example. How is a data warehouse related to data mining? **(8 Marks)**

Q10: What are Multimedia databases? What are the challenges in designing multi-media databases? Also, explain the requirements of a Geographical Information System and features of Genome databases. **(6 Marks)**

Q11: Briefly explain the architecture of the Oracle Database Management System. **(6 Marks)**

Q12: Explain the transaction management and indexing in PostgreSQL. **(6 Marks)**

Course Code	**:**	**MCS-044**
Course Title	**:**	**Mini Project**
Assignment Number	**:**	**MCA (IV)/044/Assignment**
Assignment Marks	**:**	**100**
Maximum Marks	**:**	**25%**
Last Date of Submission	**:**	**15th October (For July Session)** **15th April (For January Session)**

There are five questions in this assignment carrying 80 marks. 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 Program Guide for the format of presentation. Assumptions made if any, should be stated.

Background and Project Specifications:

A warehouse maintains the information about its inventory using a "Materials Management System". This system is used to maintain information about the receipt and issue of material to different persons/departments of the company. Every person/department in the company is given a username and password for using the Materials Management System. A person can request various items from the warehouse from their account by specifying the item code/name, quantity required and the purpose of using that item. The warehouse staff issues those items to the person and takes a receipt of the issue. The Materials management system is also used to maintain a minimum level of inventory based on its use in the warehouse. In case an item falls below the minimum level, a purchase order for those goods is generated. The system also maintains an approved list of suppliers to whom these orders are issued.

You may study the requirements for the Materials Management System in more detail. Perform the following tasks for the proposed system:

Q1: **(5+5 = 10 Marks)**

(a) Which Systems Development Life Cycle (SDLC) will you propose for the specification given above? Explain the proposed SDLC.
(b) Justify you selection by evaluating suitability of at least two SDLCs.

Q2: **(2+2+2+4=10 Marks)**

(a) What would be major costs of the system development?
(b) What may be the financial benefits of installing such a system?
(c) Perform a cost-benefit analysis for the proposed software and report its findings.
(d) List the major tasks and milestones of the Project and make a project schedule. The schedule must include both GANTT and PERT charts. Explain the two charts drawn by you.

Q3: **(10+15=25 Marks)**

(a) Study the system and create a software requirement specification. You must identify either the processes or objects while analyzing. During the analysis identify and explain possible input and output of the processes.
(b) After identifying the requirements, create Analysis Models. You may either use the classical approach and draw Entity relationship diagram and data flow diagrams (DFD's) up to level 2-3; or you may take object-oriented analysis approach and create class diagram, use case diagram, use cases etc.

Q4: **(15+10=25 Marks)**

(a) Design the system architecture and the database as per the system's needs. You must perform normalization on tables up to 3rd normal form. The table design must include Primary and Foreign keys and constraints.

(b) Create the system flow chart or detailed process design and state transition diagrams. Also design the user input screens and output report formats.

Q5:

Design various unit test cases for different testing techniques/strategies. **(10 Marks)**

Course Code	**:**	**MCSL-045**
Course Title	**:**	**UNIX and DBMS Lab**
Assignment Number	**:**	**MCA(IV)/L045/Assignment**
Maximum Marks	**:**	**100**
Weightage	**:**	**25%**
Last Dates for Submission	**:**	**15th October (For July Session)** **15th April (For January Session)**

The assignment has two parts A and B. Answer all the questions. Each part is for 20 marks. UNIX and DBMS lab record carries 40 Marks. 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 MCA Programme Guide for the format of presentation. If any assumptions made, please state them.

PART-I: MCS-041

Q1: **(5 Marks)**

Write the UNIX commands for the following:

(a) To print the calendar for the current month.
(b) To append the contents of *file1* after the contents of the *file2* and redirect them to a new *file3*.
(c) To print the first difference between any two given files.
(d) To change the command prompt from **$** to !.
(e) To grant the permissions of **r w x** to the *user* and **read, execute** permissions to the *group* and *others* for all the files in a current directory.
(f) To direct a standard output to any of the line printer.
(g) To list all the files in the current directory whose file names starts with f.
(h) To execute some command even after logout.
(i) To split a file *splittest*, which is containing 20 lines into 5 lines each which are directed to four various files.
(j) To display the last 2 lines in a given text file.

Q2:

(a) Write a shell program to count number of characters, number of lines and no. of other symbols in a given file. **(5 Marks)**

(b) Write a shell script to find whether the given year is a leap year or not. **(5 Marks)**

(c) Write a shell script to convert all the lower case letters to uppercase in a given text file. **(5 Marks)**

PART-II: MCS-043

Q1:

(a) Create an appropriate database for a ***study centre management system***. (Perform Normalization till the required levels) with meaningful data of 10 records each per table. **(10 Marks)**

(b) Perform following queries using SQL: **(5 Marks)**

(i) Find the name of the programmes those are been activated in the given study centre = "111".

(ii) Find the no. of fresh admission students in MCA and BCA programmes for Jan-2023 session allotted to study centre = "456".

(iii) Display the corresponding Regional Centre Code if the study centre code is given.

(iv) Display the list of all the academic counsellors who are counselling for MCSL-045 course.

(v) Display the total no. of assignments received in the current session for the MCSL-045 course.

(c) Write appropriate triggers, exceptions and functions for the above study centre management system database schema and describe them briefly. **(5 Marks)**