

BACHELOR OF COMPUTER APPLICATIONS (BCA_NEW)

BCA_NEW /ASSIGN/SEMESTER-III

ASSIGNMENTS

(July, 2025 & January, 2026 Sessions)

MCS-208, MCSL-209, MCS-207, BCS-131, BCSL-135, BCS-040



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

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Important Notes

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Course Code	:	BCS-040
Course Title	:	Statistical Techniques
Assignment Number	:	BCA_NEW(III)-040/Assignment/2025-26
Maximum Marks	:	100
Weightage	:	30%
Last Date of Submission	:	31 st October, 2025 (For July 2025 Session) 30 th April, 2026 (For January 2026 Session)

Note: This assignment has 8 questions of 80 marks (each question carries equal marks). Answer all the questions. The rest 20 marks are for viva voce. You may use illustrations and diagrams to enhance explanations.

Q1. The following table shows the distribution of response times (in milliseconds) for a web server over a period of 100 requests: **(10 Marks)**

Response Time (ms)	0-10	10-20	20-30	30-40	40-50	50-60
Number of Requests	8	15	25	30	12	10

- (a) Calculate the Mean and Median response time.
- (b) Calculate the Standard Deviation of the response times.
- (c) Draw a Histogram for the given data.

Q2. To study the relationship between the number of hours spent studying per week and the marks obtained in an examination, a sample of 10 students was taken. The data is as follows: **(10 Marks)**

Study Hours (X)	5	8	10	12	15	4	7	9	11	14
Marks (Y)	55	70	75	80	90	50	65	72	78	85

- (a) Calculate the Karl Pearson's coefficient of correlation between Study Hours and Marks.
- (b) Determine the two regression equations (Y on X and X on Y).
- (c) Predict the marks of a student who studies for 13 hours a week.

Q3.

(a) A software company has two divisions, A and B, developing mobile apps. Division A develops 60% of the apps, and Division B develops 40%. It is known that 5% of apps from Division A have bugs, while 8% of apps from Division B have bugs. If an app selected at random is found to have a bug, what is the probability that it was developed by Division A? **(5 Marks)**

(b) A call center receives an average of 4 calls per minute. Assuming a Poisson distribution, find the probability that in a given minute, the call center receives: **(5 Marks)**

- (i) Exactly 2 calls.
- (ii) At most 1 call.

(Given $e^{-4} \approx 0.0183$)

Q4. A manufacturer of LED bulbs claims that the average lifespan of their bulbs is 8000 hours. A random sample of 50 bulbs is tested, and it is found that their average lifespan is 7950 hours with a standard deviation of 120 hours.

Test the manufacturer's claim at a 5% level of significance. State your null and alternative hypotheses clearly. (Given $Z_{0.025} = 1.96$ for a two-tailed test). **(10 Marks)**

Q5. A survey was conducted to determine if there is a relationship between a person's age group and their preferred mode of online payment. The results are tabulated below: **(10 Marks)**

Age Group	UPI	Credit/Debit Card	Net Banking	Total
18-30	150	60	40	250
31-45	80	70	50	200
46-60	40	50	60	150
Total	270	180	150	600

Using the Chi-Square (χ^2) test, determine whether the preferred mode of payment is independent of the age group at a 5% level of significance.
(Given χ^2 critical value for 4 degrees of freedom at $\alpha=0.05$ is 9.488).

Q6.

(a) Explain the key differences between Simple Random Sampling, Stratified Sampling, and Cluster Sampling. Provide a suitable example for each to illustrate its application. **(5 Marks)**

(b) A random sample of size 100 is taken from a large population. The sample mean is found to be 150 and the population standard deviation is known to be 20. Construct a 95% confidence interval for the population mean. (Given $Z_{0.025} = 1.96$). **(5 Marks)**

Q7. An e-commerce company wants to test three different website layouts (Layout A, Layout B, Layout C) to see if they have a significant effect on the average time (in minutes) a user spends on the site. The following data was collected from different user groups:

Layout A	Layout B	Layout C
8	12	13
10	11	15
9	10	14
11	13	16
7	9	12

Perform a one-way ANOVA to test the hypothesis that there is no significant difference between the mean user session times for the three layouts at a 5% level of significance.

(Given F-critical value $F(2, 12)$ at $\alpha=0.05$ is 3.89). **(10 Marks)**

Q8.

(a) The quarterly sales (in thousands of units) of a company from 2022 to 2024 are given below.

Calculate the 4-quarterly moving averages to determine the trend.

(5 Marks)

Year	Q1	Q2	Q3	Q4
2022	30	40	36	44
2023	34	46	40	50
2024	38	52	46	56

(b) Explain the purpose of control charts in Statistical Quality Control (SQC). Differentiate between a p-chart and a c-chart with respect to the type of data they monitor.

(5 Marks)

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Course Code : **BCS-131**
Course Title : **Programming in C++**
Assignment Number : **BCA_NEW(III)-131/Assignment/2025-26**
Maximum Marks : **100**
Weightage : **30%**
Last Dates for Submission : **31st October,2025(For July 2025 Session)**
30th April, 2026 (For January 2026 Session)

This assignment has three questions carrying a total of 80 marks. Answer all the questions. Rest 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. Wherever required, you may write C++ program and take its output as part of solution

- Question 1.** What are Virtual Constructor and Virtual Destructor? What are the differences between a Virtual Constructor and a Constructor? What are the differences between a Virtual Destructor and a Destructor? Explain with examples. **(30 Marks)**
- Question 2.** What do you mean by Exception Handling? How is it implemented? What are its advantages and disadvantages? **(30 Marks)**
- Question 3.** What are the C++ header files that support the programs which draw figures? Make assumptions , if necessary. **(20 Marks)**

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Course Code	:	BCSL-135
Course Title	:	DBMS and C++ Lab
Assignment Number	:	BCA_NEW(III)-135/Assignment/2025-26
Maximum Marks	:	100
Weightage	:	30%
Last Date of Submission	:	31st October,2025(For July 2025 Session) 30th April, 2026 (For January 2026 Session)

Note: This assignment has one question with two sections for a total of 40 marks. The rest 10 marks are for viva voce. You must complete both sections. For Section A, provide the database design and SQL queries. For Section B, write the C++ program and attach its output printout.

Q1. Project: Contact Management System

You are required to design and develop a simple Contact Management System. This project will be completed in two parts: first, you will design the database schema and write SQL queries (Section A), and second, you will develop a C++ console application to manage the contacts (Section B).

Section A:

Design a database schema in **3rd Normal Form (3NF)** to store contact information.

(a) Database Schema:

Create the necessary tables to store the following information:

- A unique Contact_ID for each contact.
- The First_Name and Last_Name of the contact.
- Multiple Phone_Numbers for each contact (e.g., 'Mobile', 'Home', 'Work'). Each phone number should be stored with its type.
- Multiple Email_Addresses for each contact (e.g., 'Personal', 'Work'). Each email should be stored with its type.
- A Category for each contact (e.g., 'Family', 'Friend', 'Work').

Your design should include:

(10 Marks)

- An ER Diagram for the system.
- The final set of tables with all columns clearly defined. Underline the primary key and specify all foreign keys.

(b) SQL Queries:

Write SQL queries for the following operations on the database you designed:

(10 Marks)

1. Retrieve the full name, all phone numbers, and all email addresses of a contact with a specific Contact_ID.
2. List all contacts (First Name and Last Name) belonging to the 'Work' category.
3. Find the Contact_ID and First_Name of all contacts who have a 'Mobile' phone number.
4. Count the total number of contacts in each category.
5. List the names of contacts who have more than one phone number registered.

Section B: C++ Application Development

Write a C++ program that acts as a console-based interface for the Contact Management System. Since this is a standalone C++ application, you will manage the data using classes and file handling. **(20 Marks)**

Your program must implement the following:

1. **A Contact Class:**

- Create a class named Contact with private member variables to store contactID, firstName, lastName, and category.
- Use a std::vector or a similar container within the class to store multiple phone numbers and email addresses.
- Include a constructor and public member functions to add/edit details and display contact information.

2. **File Handling:**

- On starting the application, it should load all existing contact records from a text file named contacts.dat.
- When the user chooses to exit, the application must save all contact records (including any new or modified ones) back to the contacts.dat file.

3. **Menu-Driven Interface:**

The program should display a menu with the following options:

- **1. Add New Contact:** Prompt the user for all details and add the new contact. The contactID should be generated automatically (e.g., sequentially).
- **2. Search for a Contact:** Allow searching by contactID or lastName. Display the full details if found.
- **3. Delete a Contact:** Ask for a contactID and remove the corresponding contact record.
- **4. Update a Contact:** Ask for a contactID and allow the user to modify the contact's details.
- **5. Display All Contacts:** Display a summary (ID, Full Name, Category) of all contacts.
- **6. Exit:** Save all data to the file and terminate the program.

The program should be robust and handle basic user input errors gracefully.

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Course Code	:	MCS-207
Course Title	:	Database Management Systems
Assignment Number	:	BCA_NEW(III)-207/Assignment/2025-26
Maximum Marks	:	100
Weightage	:	30%
Last Date of Submission	:	31st October, 2025 (For July 2025 Session) 30th April, 2026 (For January 2026 Session)

There are four questions in this assignment, which carry 80 marks. Rest 20 marks are for viva voce. You may use illustrations and diagrams to enhance the explanation. Please go through the guidelines regarding assignments given in the Programme Guide for the format of the presentation. The answer to each part of the question should be confined to about 300 words. Make suitable assumptions, if any.

Question 1: (Covers Block 1)

(4+4+4+4+4= 20 Marks)

- a) What are the limitations of file-based systems? How does a database approach resolve those limitations? Also, explain the physical architecture of a database management system (DBMS).
- b) Explain the following terms in the context of a relational model with the help of one example of each:
 - (i) Key constraints
 - (ii) Domain constraints
 - (iii) Candidate key
 - (iv) Select operation
 - (v) Project Operation
 - (vi) Equijoin Operation
 - (vii) Set Difference operation
 - (viii) Referential Integrity constraint
- c) A departmental store maintains the inventory of all the items that it sells using a database system. In addition, this system is used for keeping a record of the sales of items to its registered customers. This database is used to find the following details by the staff of the departmental store:
 - List of the items that are out of stock.
 - List of customers and the items purchased by them.
 - List of all the items in the store.

Draw an ER diagram for the departmental store. Specify key attributes and constraints on each entity type and on each relationship type. Note any unspecified requirement and make appropriate assumptions to make the specification complete.

- d) Design normalised tables in 3NF for the ER diagram drawn in part (c), with the required integrity constraints.
- e) Explain the role of the primary index in a database system. Also, compare the primary indexes with the secondary indexes. What are clustering Indexes? Explain with the help of an example.

Question 2: (Covers Block 2)**(4+4+2+10= 20 Marks)**

- (a) Consider a Relation: **Course (CourseCode, CourseName, ProgrammeCode, ProgrammeName, CourseCredit, CourseDuration, ProgrammeDuration, ProgrammeCredit)**. Some of the constraints on the relation **Course** are:

- CourseCode uniquely identifies a course.
- ProgrammeCode is a unique code of a programme. A programme consists of many courses. A course can be part of multiple programmes.
- A Programme consists of compulsory courses and optional courses. To complete a Programme, a student must complete all the compulsory courses and optional courses, as per the total credit requirements of a Programme.

Perform the following tasks for the relation given above:

- (i) What is the key to the relation?
 - (ii) Identify and list the functional dependencies in the relation.
 - (iii) Make an instance of this relation consisting of at least 8 to 10 records, showing possible redundancies.
 - (iv) Decompose the relation **Course** into 2NF and 3NF relations.
- (b) What is multi-valued dependency? Explain with the help of an example. How can it be used to decompose a relation into the 4th Normal Form? Explain with the help of an example. Also, explain the concept of the Join dependency with the help of an example.
- (c) Explain the following terms with the help of an example of each: Views, Embedded SQL, Triggers and Dynamic SQL.
- (d) Consider the following relational database:

Member (memberId, memberName, memberAddress, memberPhone)

BookIssued (memberID, BookID, IssueDate, returnDate)

Book (BookId, BookTitle, FirstAuthor)

The underlined attribute(s) in the relations given above form the primary key. In relation Member the attribute memberId is the unique identifier of a member. The purposes of other attributes in the Member relation are self-explanatory. You may define the domain of different attributes. Please note that the BookIssued relation has two foreign keys, namely memberID and BookID, which reference the Member and Book relations, respectively. Write and run the following SQL queries on the database:

- (i) Create the tables with the primary and foreign key constraints.
- (ii) Insert at least 5 records each in the Member and Book tables and about 10 records in the BookIssued table.
- (iii) List the name and phone number of all the members in lexicographical order.
- (iv) Find all the Books issued to the member whose memberId is "0001".
- (v) Find the list of those members who have not returned more than one book. (Assume that a book is not returned if returnDate is NULL)
- (vi) Find the number of books whose first author's name is "XYZ".
- (vii) Find the pair of members who have the same memberPhone.
- (viii) Find the list of Books whose title includes the term "Database".
- (ix) Find the title of the book that has been issued the most.
- (x) Find the list of members who have not issued any books.

Question 3:

(a) What are the ACID (Atomicity, Consistency, Isolation, Durability) properties of a transaction? Explain each property with a suitable example related to an online banking fund transfer.

(4 Marks)

(b) Consider the following schedule involving two transactions, T1 and T2, where A and B are data items with initial values A=1000, B=2000.

Time	T1	T2
t1	READ(A)	
t2	A = A - 100	
t3		READ(A)
t4		A = A * 1.1
t5		WRITE(A)
t6		READ(B)
t7	WRITE(A)	
t8	READ(B)	
t9	B = B + 100	
t10	WRITE(B)	

(i) What is the final value of A and B after this schedule?

(4 Marks)

(ii) Is this schedule serializable? Justify your answer. Identify the specific concurrency problem (e.g., Lost Update, Dirty Read) that occurs here.

(4 Marks)

(c) Explain the Two-Phase Locking (2PL) protocol. How does it ensure serializability? Does 2PL prevent deadlocks? Explain with an example of how a deadlock can occur even when 2PL is used.

(8 Marks)

Question 4:

Write short notes on any **four** of the following, explaining their purpose and key features. Provide an example where applicable.

(4 x 5 = 20 Marks)

- (i) Distributed Databases vs. Centralized Databases
- (ii) The Star Schema in Data Warehousing
- (iii) NoSQL Databases (Explain one type, e.g., Document, Key-Value, or Graph)
- (iv) Query Optimization in RDBMS
- (v) Log-Based Recovery and the role of Checkpoints

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Course Code	:	MCS-208
Course Title	:	Data Structures and Algorithms
Assignment Number	:	BCA_NEW(I)-208/Assignment/2025-26
Maximum Marks	:	100
Weightage	:	25%
Last Dates for Submission	:	31st October,2025(For July 2025 Session) 30th April, 2026 (For January 2026 Session)

There are four questions in this assignment, which carry 80 marks. Each question carries 20 marks. Rest 20 marks are for viva voce. All algorithms should be written nearer to C programming language. You may use illustrations and diagrams to enhance the explanations, if necessary. Please go through the guidelines regarding assignments given in the Programme Guide for the format of presentation.

Question 1: For each of the Singly Linked List, Circularly Singly Linked List, Doubly Linked List, Circularly Doubly Linked List, write one application that is exclusively suitable for that list. For example, X may be an application for whose implementation, only Circularly Singly Linked List is suitable and others are not suitable. Justify your answer.

Question 2: We can test whether a node ‘ m’ is a proper ancestor of a node ‘ n’ by testing whether ‘ m’ precedes ‘ n’ in X-order but follows ‘ n’ in Y-order , where X and Y are chosen from {pre, post, in}. Determine all those pairs X and Y for which this statement holds.

Question 3: Explain Left Leaning Red Black Trees. What are their advantages and disadvantages?

Question 4: Write a short note on the recent developments in the area of finding minimum cost spanning trees.

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Course Code	:	MCSL-209
Course Title	:	Data Structures and Algorithms Lab
Assignment Number	:	BCA_NEW(III)L-209/Assignment/2025-26
Maximum Marks	:	100
Weightage	:	25%
Last Dates for Submission	:	31st October,2025(For July 2025 Session) 30th April, 2026 (For January 2026 Session)

There are two questions in this assignment carrying a total of 40 marks. Each question carries 20 marks. Your Lab Record will carry 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 Programme Guide for the format of presentation.

Question 1: Write an algorithm and program in ‘C’ language to merge two sorted linked lists. The resultant linked list should be sorted.

Question 2 : Write an algorithm and a program in ‘C’ language to insert and delete edges in an adjacency list representation of an undirected graph. Make assumptions, if necessary.