BACHELOR OF COMPUTER APPLICATIONS (BCAOL)

(Revised Syllabus)

BCA(Revised Syllabus)/ASSIGN/SEMESTER-IV

ASSIGNMENTS

(July – 2025 & January – 2026 sessions)

(BCS-040, MCS-024, BCS-041, BCS-042,

MCSL-016, BCSL-043, BCSL-044, BCSL-045)

SCHOOL OF COMPUTER AND INFORMATION SCIENCES
INDIRA GANDHI NATIONAL OPEN UNIVERSITY
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CONTENTS

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 BCA 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 BCA Programme Guide.

Course Code	**:**	**BCS-040**
Course Title	**:**	**Statistical Techniques**
Assignment Number	**:**	**BCA(IV)040/Assignment/2025-26**
Maximum Marks	**:**	**100**
Weightage	**:**	**25%**
Last Date of Submission	**:**	**31st October, 2025 (For July session)**
		30th April, 2026 (For January 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)**

Course Code	**:**	**MCS-024**
Course Title	**:**	**Object Oriented Technologies and Java Programming**
Assignment Number	**:**	**BCA (IV)/024/Assignment/2025-26**
Maximum Marks	**:**	**100%**
Last Date of Submission	**:**	**31st October, 2025 (For July session)** **30th April, 2026 (For January session)**

There are Three questions in this assignment which carry 80 marks, in total. Rest 20 marks are for viva-voce. Answer all the questions. Give appropriate comments in programs to increase understandability. Wherever required, you may write java program, run it on machine and take its output as part of solution. Please go through the guidelines regarding assignments given in the Programme Guide for the format of presentation.

Q1. Give an example of a Project that is suitable for development in Java Programming Language rather than any other Object Oriented Programming Language. Justify your answer point wise in detail. **(30 marks)**

Q2. Give an example of a Project that is not suitable for development in Java Programming Language. Justify your answer point wise in detail. **(30 marks)**

Q3. Compare Procedural Programming paradigm with Object Oriented Programming paradigm with an example.

(20 marks)

Course Code	**:**	**BCS-041**
Course Title	**:**	**Fundamentals of Computer Networks**
Assignment Number	**:**	**BCA (IV)/041/Assignment/2025-26**
Maximum Marks	**:**	**100**
Weightage	**:**	**25%**
Last Date of Submission	**:**	**31st October, 2025 (For July Session)** **30th April, 2026 (For January Session)**

Note: This assignment has eight questions for a total of 80 marks. Answer all the questions. Each question carries 10 marks. The rest 20 marks are for viva voce. You may use illustrations and diagrams to enhance explanations.

Q1. An organization is assigned a network block of **202.41.80.0/26**. The administrator needs to further divide this block into smaller subnets. **(10 Marks)**

(a) How many subnets can be created from this block if each new subnet requires at least 25 hosts?
(b) What will be the new subnet mask for these smaller subnets?
(c) For the first two of these new subnets, provide the:
(i) Subnet Address
(ii) Range of Usable Host IP Addresses
(iii) Broadcast Address

Q2. Imagine you open a web browser and type https://www.ignou.ac.in and press Enter. Trace the journey of this request from your computer to the IGNOU server. Explain the role of at least four different protocols (e.g., DNS, HTTP, TCP, IP) and how the TCP/IP layers on your machine (Application, Transport, Network, Data Link) encapsulate the data to make this happen.

(10 Marks)

Q3.

a) A sender needs to transmit the data frame 10111001. The generator polynomial to be used for CRC is $P(x) = x^3 + 1$. Calculate the CRC checksum and determine the final codeword that will be transmitted. Show all steps of the binary division. **(5 Marks)**
b) Why is CRC considered a more robust error detection mechanism compared to a two-dimensional parity check? **(5 Marks)**

Q4. Differentiate between CSMA/CD and CSMA/CA based on the following criteria: **(10 Marks)**

(a) Full Form and Primary Goal (Detecting vs. Avoiding Collisions).
(b) Typical Network Environment (Wired Ethernet vs. Wireless LAN).
(c) Mechanism (How it handles channel access and collisions).
(d) Acknowledgment (Whether acknowledgments are typically used).

Q5. Compare and contrast **Distance-Vector** and **Link-State** routing algorithms. Your answer should cover: **(10 Marks)**

a) The information shared between routers (Routing table vs. Topology map).
b) The frequency and scope of updates.
c) **Susceptibility** to common problems like the "Count-to-Infinity" problem and slow convergence.
d) Provide one example protocol for each algorithm (e.g., RIP, OSPF).

Q6.

a) Compare TCP (Transmission Control Protocol) and UDP (User Datagram Protocol) based on their reliability, connection management, and flow control mechanisms. **(6 Marks)**

b) For each of the following applications, choose whether TCP or UDP would be more appropriate and justify your choice in one sentence: **(4 Marks)**
   (i) Live video streaming
   (ii) A large file download
   (iii) A DNS query
   (iv) Online banking transaction

Q7. Write short notes on the primary function and working mechanism of the following application layer protocols:

a) **DNS (Domain Name System):** Explain how it resolves a domain name into an IP address. **(4 Marks)**

b) **FTP (File Transfer Protocol):** Explain the purpose of its two connections (control and data). **(3 Marks)**

c) **SMTP (Simple Mail Transfer Protocol):** Describe its role in sending an email from a client to a server. **(3 Marks)**

Q8.

a) Explain the fundamental difference between Symmetric Key Cryptography and Asymmetric Key Cryptography in terms of the keys used for encryption and decryption. **(4 Marks)**

b) In an RSA cryptosystem, the prime numbers chosen are $p = 5$ and $q = 11$, and the public exponent is $e = 7$.
   (i) Calculate the value of n and $\varphi(n)$. **(2 Marks)**
   (ii) Determine the private key d. **(2 Marks)**
   (iii) Encrypt the message $M = 8$. **(2 Marks)**

Course Code	**:**	**BCS-042**
Course Title	**:**	**Introduction to Algorithm design**
Assignment Number	**:**	**BCA(IV)/042/Assignment/2025-26**
Maximum Marks	**:**	**100**
Weightage	**:**	**30%**
Last date of Submission	**:**	**31st October, 2025 (For July Session)**
	:	**30th April, 2026 (For January Session)**

This assignment has 8 questions of 10 Marks each, answer all questions. Rest 20 marks are for viva voce. Please go through the guidelines regarding assignments given in the Programme Guide for the format of presentation.

Q1. Explain the following fundamental techniques, used to design an algorithm efficiently:

- Divide-and-Conquer
- Greedy method
- Dynamic Programming
- Backtracking
- Branch-and-Bound

Q2. Prove the following proposition using induction:

P(n): $1^1 + 2^2 + 3^2 + 4^2 + \cdots \ldots \ldots \ldots \ldots \ldots + n^2 = \frac{n(n+1)(2n+1)}{6}$

Q3. For the function defined by $f(n) = 2n^3 + 3n^2 + 1$ and $g(n) = 2n^2 + 3$, show that

(i) $f(n) = \Omega(g(n))$ (ii) $g(n) != \Omega(f(n))$ (iii) $n^3 = \Omega(g(n))$ (iv) $f(n) != \Omega(n^4)$

Q4. Solve the following recurrence Using Recursion tree method

(i) $T(n) = 3T(\frac{n}{2}) + n$

(ii) $T(n) = 2T(\frac{n}{2}) + n^2$

(iii) $T(n) = T(\frac{n}{2}) + T\left(\frac{n}{4}\right) + T\left(\frac{n}{8}\right) + n$

Q5. Analyze best case, average case, and worst-case time complexities of following algorithms with the help of suitable examples.

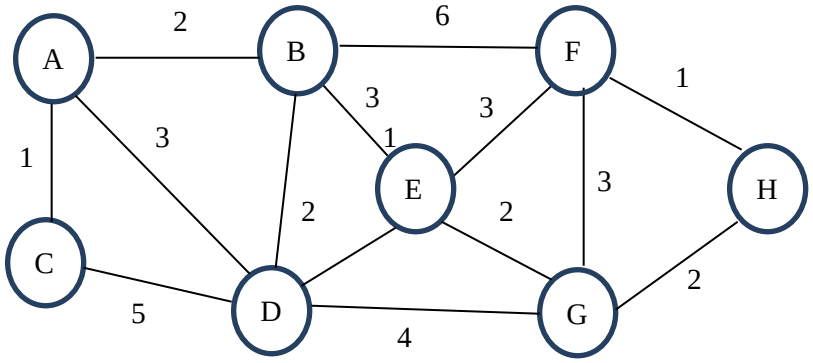
(i) Insertion sort

(ii) Binary sort

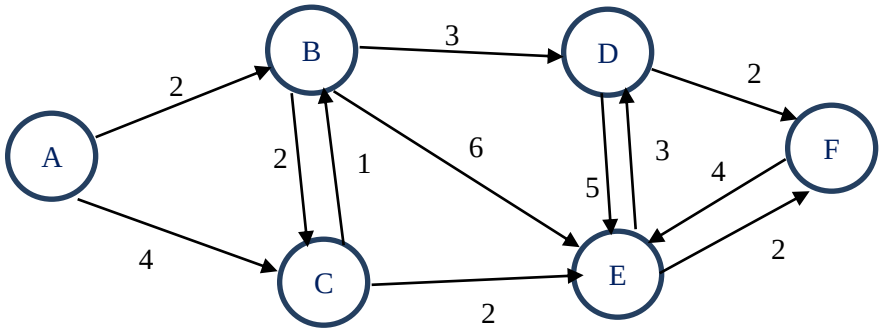
(iii) Binary search

(iv) Merge sort

Q6. Apply Kruskal's Algorithm on the following graph to find minimum cost spanning tree



Q7. Apply Dijkastra's Algorithm to find the shortest path from source vertex 'A' to all other vertices for following graph.



Q8. Explain DFS and BDS Graph traversal algorithms with the help of a suitable example.

Course Code	**:**	**MCSL-016**
Course Title	**:**	**Internet Concepts and Web Design (Lab Course)**
Assignment Number	**:**	**BCA(IV)/L-016/Assignment/2025-26**
Maximum Marks	**:**	**100**
Weightage	**:**	**25%**
Last Dates for Submission	**:**	**31st October, 2025 (For July Session)**
		30th April, 2026 (For January Session)

There are two questions in this assignment carrying a total of 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 Programme Guide for the format of the presentation. Submit the screenshots along with the coding and documentation.

Question 1: **(70 Marks)**

A bookstore sells its books using a website. The website displays the list of books in lexicographic order of the book title. The list of books includes the title of the book, the first author, the year of publication of the book, and the price of the book. In addition, the website also displays two forms – the first form allows a customer to register with the bookstore, and the second form is for feedback about the website.

Design and create four web pages for the bookstore, namely, *Home*, *ListOfBooks*, *Customer_Registration* Form and *Feedback* Form, having the following features:

For consistency, every webpage of the proposed website should consist of three basic divisions –

Header – This division should be the same for all four web pages and should display the name and logo of the bookstore. This division should have a different background colour.

Link - This division should be the same for every web page. It should contain links to all the web pages, viz. *Home*, *ListOfBooks*, *Customer_Registration* Form and *Feedback* Form.

Information - This division should display the basic information, as given below. The web pages that you are designing should differ in this Division only.

The Information division of the different pages should be as under:

- *Home* page should welcome all the successful customers to the bookstore.
- *ListOfBooks* page should display information about all the books. You should display this information by using a table.
- *Customer_Registration* page should contain a form, which should have fields – Name of the Customer, His/her interest in books, contact number and a SUBMIT button. You should write JavaScript code to verify that all the fields are filled with some data. This code should be run when the Submit button is pressed.
- The *Feedback* page should display another form that has two input fields – The name of the customer and a text area for giving feedback. This form should also have a SUBMIT button.

You must submit the hard copy of the HTML code of every web page and screenshots of the display of the web pages in a browser window. You should demonstrate these webpages at the time of the viva

Question 2: **(10 Marks)**

What are the advantages of using a style sheet along with an HTML web page? Explain with the help of an example. List the advantages of using JavaScript for web page development.

Course Code	**:**	**BCSL-043**
Title	**:**	**Java Programming Lab**
Assignment Number	**:**	**BCA(IV)/L-043/Assignment/2025-26**
Maximum Marks	**:**	**50**
Last date of Submission	**:**	**31st October, 2025 (For July Session)** **30th April, 2026 (For January Session)**

This assignment has two questions. Answer all the questions. These questions carry 40 marks. Rest 10 marks are for viva voce. You are advised to give proper comments and do proper alignments while writing program. Please go through the guidelines regarding the assignments given in the programme guide for the format of presentation.

Q1(a).
Write java program to find the multiplication of two matrices. Define appropriate class, constructor and methods in your program. Make necessary assumptions. **(10 Marks)**

Q1(b).
Write a Java program that takes the marks of 20 Students in the "Java Programming" course as input and displays the highest and lowest marks scored by the students. Make provisions for exception handling in the situation when the marks entered are either a negative value or more than 100. **(10 Marks)**

Q2(a).
Write a Java program that creates the threads T1 and T2. Thread T1 displays the table of 8 and thread T2 displays the table of 7. Assign priorities 3 and 5 to these threads, respectively. **(10 Marks)**

Q(b).
Create an applet that takes a number between 1 and 50 as input and displays whether the number is prime or not. Use appropriate components, layout and formatting in your program. **(10 Marks)**

Course Code	**:**	**BCSL-044**
Course Title	**:**	**Statistical Techniques Lab**
Assignment Number	**:**	**BCA(IV)/L-044/Assignment/2025-26**
Maximum Marks	**:**	**50**
Weightage	**:**	**25%**
Last Dates for Submission	**:**	**31st October, 2025 (For July Session)**
		30th April, 2026 (For January Session)

This assignment has five questions of total of 40 marks. Rest 10 marks are for viva voce. Please go through the guidelines regarding assignments given in the programme guide for the format of presentation.

Q1. The weight of 20 students of class X in kgs in given in the following table. **(4+2+2+2 =10 marks)**

65.5	52.5	39.2	47.7	67.5
45.9	55.3	59.5	70.1	62.5
39.9	65.2	42.9	56.3	59.5
62.3	54.2	51.3	47.6	69.5

Perform the following tasks for the data given above:

(a) Enter the data in the spreadsheet package and create a frequency distribution in 8 ranges of equal interval. The frequency distribution may be created using array formula.

(b) Draw the histogram for the data.

(c) Find the mean and variance for the data using spreadsheet.

(d) Find the maximum and minimum weight using spreadsheet formula.

Q2. Consider the following data of sales of wheat by a farm house in a week:

(5 Marks)

Day	Sales (Kgs)
Monday	200
Tuesday	175
Wednesday	150
Thursday	125
Friday	250
Saturday	300
Sunday	350

Find the moving averages of length 4 and 5. Plot these moving averages using spreadsheet.

Q3. A company has the following production and sales data. **(5+ 5 = 10 marks)**

Production in (Nos)	Sales in INR
40	30,000
50	75,000
60	60,000
90	80,000
70	75,000
45	60,000
80	55,000

(a) Construct a scatter plot (diagram) for the given data using a spreadsheet package.

(b) Find the best linear regression line, assuming that sales in an independent variable and production is a dependent variable. Explain your answer.

Q4. The following table shows the data on mortality rate of plants on use of a new fertilizer. Use chi-square or any other test to determine, if the fertilizer has any effect on enhancing the living rate.

(8 marks)

Categories	Living	Dead	Total
Not given fertilizer	427	219	646
Given fertilizer	297	130	427

Explain your results.

Q5. The sugar level of 6 patients were recorded before and after taking a new drug:

(7 Marks)

Before	130	200	100	95	125	150
After	95	120	99	90	100	110

Using t-test and a significance level of 5% can you determine if the new drug causes significant reduction in sugar level. You must write H_0 and H_1 clearly and explain your results.

Course Code	**:**	**BCSL-045**
Course Title	**:**	**Introduction to Algorithm design Lab**
Assignment Number	**:**	**BCA(IV)/L-045/Assignment/2025-26**
Maximum Marks	**:**	**50**
Weightage	**:**	**25%**
Last date of Submission	**:**	**31st October, 2025 (For July Session)**
	:	**30th April, 2026 (For January Session)**

Note: Answer all the questions which carry 40 marks. All questions are of equal marks.The rest 10 marks are for viva voce. You are required to write programs in C-language for all the problems, execute and show the results. 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. Make suitable assumption if necessary.

Q1. Implement and compare time complexity of Merge Sort and Quick Sort for randomly generated arrays of sizes 10 and 50. Display loop counts and timing results to determine efficiency in practice. **(8 Marks)**

Q2. Write a C program to simulate the recursive and iterative versions of the Fibonacci sequence generation. Analyze and compare their time and space complexities. **(8 Marks)**

Q3. Develop a C program to calculate power $\mathbf{a^n}$ using both Binary Exponentiation and the Naive method. Compare the number of multiplications in both methods for different values of *n*. **(8 Marks)**

Q4. Implement Dijkstra's algorithm for a graph with 5 nodes using adjacency list representation. Display the shortest path tree and explain how the greedy choice is applied at each step. **(8 Marks)**

Q5. Write a C program to perform and visualize DFS and BFS traversal of a user-defined undirected graph. Record and report the order of traversal and number of operations. **(8 Marks)**