MASTER OF COMPUTER APPLICATIONS (MCA_NEW)

MCA_NEW 1st Semester Assignments

(January, 2026 & July, 2026 sessions)

MCS-211, MCS-212, MCS-213, MCS-214, MCS-215

MCSL-216, MCSL-217

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

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Course Code	**:**	**MCS-211**
Course Title	**:**	**Design and Analysis of Algorithms**
Assignment Number	**:**	**MCA_NEW(I)/211/Assign/2026**
Maximum Marks	**:**	**100**
Weightage	**:**	**30%**
Last Dates for Submission	**:**	**30th April 2026 (for January Session)**
		31st October 2026 (for July Session)

This assignment has four questions (80 Marks). Answer all questions. The remaining 20 marks are for your viva voce examination. You may use illustrations and diagrams to enhance the explanations. Please go through the guidelines regarding assignments given in the Programme Guide for the presentation format.

Q1:

a) Design and develop an efficient algorithm to find all the prime numbers in the range 2 to 10000.Access the complexity of this algorithm? **(2 Marks)**

b) Differentiate between Quadratic-time and Exponential-time algorithms. Give example of one problem each for these two running times. **(2 Marks)**

c) A sorted array of size n contains several duplicate values. Design an algorithm to search a value in the array. The algorithm should output all the indexes where the searched value exists. Explain the worst time complexity of this algorithm. **(2 Marks)**

d) Explain the Big Theta (Θ) and Big Omega (Ω) notations with the help of a diagram. What is the need of asymptotic bounds? Also, list the shortcomings of the asymptotic bounds. Find the Big O, Θ and Ω bounds for the following function: **(4 Marks)**

$$f(n)= 999n^3+999999n+100$$

e) Write the Right to Left binary exponentiation algorithm. Demonstrate the use of this algorithm to compute the value of 5^{23}. Show all steps of the computation. Explain the worst-case complexity of this algorithm. **(4 Marks)**

f) Write and explain the Insertion sort algorithm. Discuss its best and worst-case time complexity. **(3 Marks)**

g) What is a recurrence relations? When are they used? Solve the following recurrence relations using the Master's method **(3 Marks)**

a. $T(n) = 16T\left(\frac{n}{4}\right) + n^2$

b. $T(n) = 8T\left(\frac{n}{2}\right) + n^2$

Q2:

a) How can an optimisation problem be represented mathematically. Explain with the help of an example. Explain the steps of designing a Greedy solution for an optimisation problem. Also explain the concept of local and global optimal solutions. Solve the following fractional Knapsack problem using greedy approach. Show all the steps. **(4 Marks)**

Suppose there is a knapsack of capacity 10 Kg and the following 5 items are to packed in it. The weight and profit of the items are as under:

$(p_1, p_2,\ldots, p_5) = (10, 20, 18, 15, 5)$
$(w_1, w_2,\ldots, w_5) = (2, 5, 3, 5, 1)$

b) Assuming that data to be transmitted consists of only characters'a' to 'g', design the Huffman codes for the following frequencies of character data. Show all the steps of building a Huffman tree. Also, show how a coded sequence using Huffman code can be decoded. **(4 Marks)**

a:25, b:3, c:2,d:6, e:40, f:14, g:10

c) Expalin the PARTITION algorithm of the Quick Sort taking the last element as pivot. Demonstrate the use of Quick sort algorithm for sorting the following data of size 8: [1, 5, 8, 11, 16, 19, 29, 38]. Compute the complexity of the worst case of Quick Sort algorithm. **(4 Marks)**

d) Explain the divide and conquer approach of multiplying two large matrices of size 16 × 16. Compute the time complexity of this approach. **(4 Marks)**

e) Write and explain the algorithm of Topological sorting with the help of an example. Also, define the concept of strongly connected components in a directed Graph. **(4 Marks)**

Q3: Consider the following Graph:

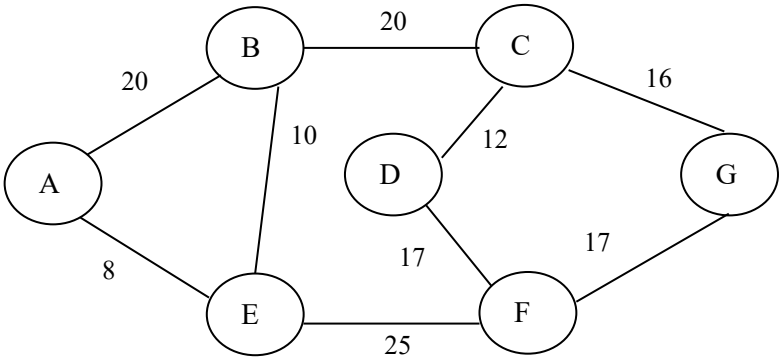

Figure 1: A sample weighted Graph

a) Write the Kruskal's algorithm to find the minimum cost spanning tree of a graph. Also, find the time complexity of Kruskal's algorithm. Demonstrate the use of Kruskal's algorithm and Prim's algorithm to find the minimum cost spanning tree for the Graph given in Figure 1. Show all the steps. **(4 Marks)**

b) Write the Bellman-Ford shortest path algorithm. What is the time complexity of this shortest path algorithm? Find the shortest paths from the vertex 'A' using Bellman-Ford's shortest path algorithm for the graph given in Figure 1. Show all the steps of computation. **(4 Marks)**

c) Write the algorithm to find the Optimal Binary Search Tree. Demonstrate this algorithm to find the Optimal Binary Search Tree for the following probabilities of search (where p_i represents the probability that the search will be for the key node k_i, whereas q_i represents that the search is for dummy node d_i. Make suitable assumptions, if any) **(6 Marks)**

i	0	1	2	3	4
p_i		0.15	0.05	0.15	0.25
q_i	0.10	0.05	0.05	0.10	0.10

d) Given the following sequence of chain multiplication of the matrices. Find the optimal way of multiplying these matrices: **(2 Marks)**

Matrix	Dimension
A1	25 × 10
A2	10 × 35
A3	35 × 10
A4	10 × 30

e) Explain the Knuth Morris Pratt (KMP) algorithm for finding a string in a text/paragraph with the help of an example. Find the time complexity of this algorithm. **(4 Marks)**

Q4: a) Explain the term intractable problems with the help of an example. Define the following problems with the help of an example. **(4 Marks)**

(i) Travelling Salesman Problem
(ii) Clique Problem

b) What are NP and NP-Complete classes of problems? Explain with the help of at least two examples each. **(4 Marks)**

c) Define the relationship between P, NP, NP-Complete and NP-Hard classes of problems. How are they different from each other. **(4 Marks)**

d) Describe the following Problems: **(8 Marks)**

(i) 3-CNF SAT Problem
(ii) 0/1 Knapsack Problem
(iii) Vertex Cover Problem
(iv) Graph colouring problem

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Course Code	**:**	**MCS-212**
Course Title	**:**	**Discrete Mathematics**
Assignment Number	**:**	**MCA_NEW(I)/212/Assign/2026**
Maximum Marks	**:**	**100**
Weightage	**:**	**30%**
Last Dates for Submission	**:**	**30th April 2026 (for January Session)** **31st October 2026 (for July Session)**

This assignment has twenty questions of 80 Marks; all questions carry equal marks i.e. 4 marks. 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 for the format of presentation.

Q1: Use Mathematical Induction to prove that : $1^2 + 2^2 + \ldots\ldots\ldots + n^2 = n(n+1)(2n+1)/6$

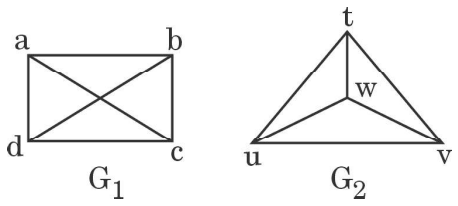
Q2: How many different permutations are possible of the letters, taken all at a time, of the word: ASSESSES?

Q3: A die is rolled once. What are the probabilities of the following events:

a. Gettinganoddnumber
b. Gettingatleastavalue2
c. Gettingatmostavalue2
d. Gettingatleast7

Q4: Draw a hypercube graph Q_3(also called the cubical hypercube). Check whether the hypercube Q3 is Hamiltonian

Q5: What is isomorphism? Find, if the following graphs G_1 and G_2 are isomorphicornot. Explain how you arrived at your answer.



Q6: What is a finite automata ? Why is it needed? How is a finite automata represented?. Also explain the term regular expression with the help of an example.

Q7: Differentiate between

a. Deterministic and Non-deterministic finite automata
b. Deterministic and Non-deterministic Turing Machine
c. Moore and Mealy Machine

Q8: Describe the divide-and-conquer approach to solve recurrences ? Explain how this approach can be used toapplybinarysearchinasortedlist.

Q9: What is proposition ? Explain with the help of an example. Explain Disjunction and Conjunction with the help of truth table for each.

Q10: Prove the following theoremby direct proof method: ‘‘The squareofanevenintegerisaneven integer.’’

Q11: Given the Boolean expression$(a' \vee (b \wedge c')) \vee (b \vee d')$,draw the corresponding circuit, where a, b, c and d

are the inputs to the circuitry.

Q12: Define the terms Domain, Co-domain and Range in the context of a function. Also find the domain, co-domain and range for a function A to B , where A={1,2,3,4}and B={1,4,9,16,25}.

Q13: A committee consisting of 2 male and 2 female workers is to be constituted from 8 male and 9 female workers. In how many distinct ways can this be done?

Q14: In a tennis tournament, each entrant plays a match in the first round. Next, all winners from the first round play a second-round match. Winners continue to move on to the next round, until finally only one player is left as the tournament winner. Assuming that tournaments always involve $n = 2^k$ players, for some k, find the recurrence relation for the number rounds in a tournaments of n players.

Q15: Show, using the pigeonhole principle, that in any group of 30 people, 5 people can always be found who were born on the same day of the week.

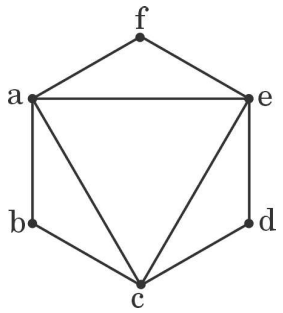
Q16: Define the following in the context of graph, with the help of an example:

a. Complete graph
b. Degree of a vertex
c. Cycle
d. Path
e. Circuit

Q17: What is a bipartite graph ? Explain with the help of an example. Give one or two applications of bipartite graphs.

Q18: How Hamiltonian graphs differ from the Eulerian graphs? Give Dirac's and Ore's criterion for the Hamiltonian graphs.

Q19: Differentiate between Eulerian graph and Eulerian circuit.Find the Eulerian circuit in the graph given below(if it exists).



Q20: Write Short notes on following.

a. Travelling Salesman Problem
b. Vertex Coloring
c. Edge Coloring
d. Planar graphs
e. Pascal's Formula

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Course Code	**:**	**MCS-213**
Course Title	**:**	**Software Engineering**
Assignment Number	**:**	**MCA_NEW(I)/213/Assign/2026**
Maximum Marks	**:**	**100**
Weightage	**:**	**40%**
Last Dates for Submission	**:**	**30th April 2026 (for January Session)** **31st October 2026 (for July 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.

Q1:

Assume that you are assigned responsibility of developing an **Online Programme Eligibility Checking System (OPECS)** for a University. **OPECS** should be a web based system. **OPECS** will have fields such as Programme Code (To select the Programme whose eligibility for admission is sought), Qualification Code (To select the Programme which is the qualification of applicant for admission to Programme with Programme Code), Course Codes (To select multiple courses which are part of the Programme with the qualification code), Percentage (To select the nearest aggregate percentage of marks secured in the Programme selected under Qualification code), SUBMIT (a Submit button which when clicked displays whether the candidate whose particulars are filled is eligible for admission to the Programme with Programme Code). Make assumptions wherever necessary.
For developing **OPECS** as specified above,

(a) Which SDLC paradigm will be selected. Justify your answer. **(15 Marks)**
(b) List the functional and non-functional requirements. **(15 Marks)**
(c) Estimate cost. **(15 Marks)**
(d) Estimate efforts. **(15 Marks)**
(e) Develop SRS using IEEE format. **(20 Marks)**

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Course Code	**:**	**MCS-214**
Course Title	**:**	**Professional Skills and Ethics**
Assignment Number	**:**	**MCA_NEW(I)/214/Assign/2026**
Maximum Marks	**:**	**100**
Weightage	**:**	**30%**
Last date of Submission	**:**	**30th April 2026 (for January session)** **31st October 2026 (for July session)**

This assignment has eight questions. Answer all questions. 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:

Read the following passage and answer the questions below:

WORK ETHICS IN THE DIGITAL AGE

In today's digital workplace, professional ethics extends beyond punctuality and discipline. With remote working, digital collaboration platforms, and artificial intelligence tools becoming common, employees are expected to demonstrate integrity, accountability, and responsible digital behavior.

Data privacy is one of the most critical ethical concerns. Employees often handle sensitive customer data, financial records, and confidential reports. A single careless action—such as sharing login credentials or forwarding confidential emails—can lead to serious consequences.

Another growing concern is the ethical use of AI tools. While AI improves efficiency, blindly relying on automated outputs without verification can lead to misinformation, plagiarism, or biased decisions. Professionals must ensure transparency when AI tools assist in generating reports or analysis.

Digital communication also demands ethical sensitivity. Misinterpretation, inappropriate tone, or unprofessional comments on emails and social media can damage personal and organizational reputation.

Ethics in the digital age is not merely about following rules—it is about building trust in a connected and transparent world.

a) What does the passage say about professional ethics in the digital workplace? **(3 Marks)**

b) Why is data privacy considered a critical ethical concern? **(3 Marks)**

c) What are the risks of blindly relying on AI tools? **(4 Marks)**

d) How can digital communication impact professional reputation? **(3 Marks)**

e) Explain the statement: "Ethics is about building trust." **(3 Marks)**

f) Complete the table: **(4 Marks)**

Issue	Ethical Concern
Data Sharing	
AI Tools	
Social Media Use	
Email Communication	

Q2: Write a formal email based on the following situation: **(10 Marks)**
You are a Project Coordinator. A team member has repeatedly missed deadlines for submitting progress reports.

- Remind the member about deadlines
- Explain the importance of timely reporting
- Offer support if needed
- Maintain a professional and positive tone

Q3: Write short notes on the following: **(20 Marks)**

i) Cyber Security Awareness for Professionals
ii) Conflict Resolution in Teams
iii) Intellectual Property Rights in Software Development
iv) Workplace Diversity and Inclusion

Q4: Your department recently conducted a **"Digital Ethics Awareness Workshop"** for MCA students. Prepare a brief report covering: **(10 Marks)**

- Objectives of the workshop
- Key topics covered
- Resource persons
- Student participation
- Outcomes and feedback

Q5: An IT company is hiring for the position of **Junior Software Analyst**. **(10 Marks)**
Requirements:

- MCA / B.Tech (IT/CS)
- Knowledge of Python/Java
- Good communication skills
- Freshers can apply

Prepare your Curriculum Vitae suitable for this position.

Q6: Fill in the blanks with suitable prepositions: **(5 Marks)**

1. Professional ethics is essential _____ maintaining trust.
2. She is responsible _____ preparing the final report.
3. The meeting will start _____ 10 a.m.
4. Data must be protected _____ unauthorized access.
5. He has been working here _____ 2022.

Q7: These are the answers to ten questions. Write the Wh- questions. **(10 Marks)**
Example: Who does Rahul for? Rahul works for JTN.

i) …….. The project deadline is next Friday.

ii) …… She works in the cybersecurity department

iii) …… There are eight members in the team.

iv) …… He joined the company in 2023.

v) …… The software was developed using Python.

vi) …… They are conducting the meeting online.

vii) …… The report was rejected due to plagiarism.

viii) …… She has been working remotely since March.

ix) …… The client is based in Singapore.

x) …… He left the job for better opportunities.

Q8: Prepare a presentation (approximately 200 words) on ***any one*** of the following: **(15 Marks)**

- Artificial Intelligence and its Social Impact.
- Professional Conduct in Remote Work Environment
- Cyber Security Best Practices for IT Professionals

Before you begin, clearly indicate:

- Who you are
- Who your audience is
- Whether the occasion is formal or informal
- Teaching aids/props used (PPT, projector, whiteboard, etc.)

The presentation must be in about 200 words.

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Course Code	**:**	**MCS-215**
Course Title	**:**	**Security and Cyber Laws**
Assignment Number	**:**	**MCA_NEW(I)/215/Assign/2026**
Maximum Marks	**:**	**100**
Weightage	**:**	**30%**
Last date of Submission	**:**	**30th April 2026 (for January session)** **31st October 2026 (for July session)**

This assignment has six questions. Answer all questions. The remaining 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.

Q1: **(3*4= 12 Marks)**

(a) What are the three pillars of digital security? Explain any three benefits of digital security.
(b) Explain the following in the context of security threats and vulnerabilities**:**
(i) Phishing
(ii) Distributed Denial of Service Attack
(iii) Web Jacking
(c) Explain the technology safeguards that can help you counter the cybersecurity threats asked in part (b) of this question.
(d) What are the laws governing punishments against Social Engineering Attacks and Malware?

Q2: Explain the following terms with the help of an example of each, giving their advantages and disadvantages. **(3*6=18 Marks)**

(a) Substitution Ciphers
(b) Functions of Cryptography
(c) Steganography
(d) Symmetric Key Cryptography
(e) Electronic Signature
(f) Pseudo-Random Numbers and Sequences

Q3: **(3*4= 12 Marks)**

(a) Explain the key concerns that are to be addressed when you implement the CIA triad indata security.
(b) Explain the following security threats or attacks:
(i) State-sponsored attacks
(ii) Cyber-physical attacks
(c) Explain the following data security measures:
(i) Anti-Virus Protection
(ii) Access Security
(d) Explain the terms security policy and security management. How can you balance system security and user convenience**?** Explain.

Q4: **(3*4= 12 Marks)**

(a) What is the need for the regulation of Cyberspace? Explain.
(b) What are the uses of filtering devices and rating systems for Internet content? Explain with the help of an example of each.
(c) Explain the key principles and provisions of the UNCITRAL Model Law on Electronic Commerce.
(d) Explain the international initiatives for the regulation of cyberspace.

Q5: **(3*5= 15 Marks)**

(a) What is the classification of cybercrimes? Explain with the help of examples. Also, differentiate between cybercrime and traditional crime. Give one example of each.
(b) List the Penalties and compensation in Section 43 of the Information Technology Act 2000.
(c) List and explain any three sections from section 68 to section 72 as per the Information Technology Act, 2000.
(d) Explain the role of cyber forensics with the help of an example.
(e) List and explain any four cyber forensic techniques.

Q6: **(6+3+2= 11 Marks)**

(a) Explain the following forms of IPR with the help of an example of each:
(i) Patents.
(ii) Open license CC BY SA
(iii) Trademarks
(b) Explain domain name disputes and manipulation of search engine ranking with the help of an example of each.
(c) Briefly discuss the remedies that are available for the protection of Intellectual Property Rights.

MASTER OF COMPUTER APPLICATIONS (MCA_NEW)

MCA_NEW 1st Semester Assignments

(January, 2026 & July, 2026 sessions)

MCS-211, MCS-212, MCS-213, MCS-214, MCS-215

MCSL-216, MCSL-217

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

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Important Notes

1. Submit your assignments to the Coordinator of your Study Centre on or before the due date. Also, be in touch with concerned IGNOU RC for any updates regarding assignments schedule etc.
2. Assignment submission before due dates is compulsory to become eligible for appearing in corresponding Term End Examinations. For further details, please refer to Programme Guide of MCA_NEW.
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 Programme Guide of MCA_NEW.
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.

Course Code	**:**	**MCSL-216**
Course Title	**:**	**DAA and Web Design Lab**
Assignment Number	**:**	**MCA_NEW(I)/L-216/Assign/2026**
Maximum Marks	**:**	**100**
Weightage	**:**	**30%**
Last Dates for Submission	**:**	**30th April 2026 (for January session)** **31st October 2026 (for July session)**

This assignment has two sections. Answer all questions in each section. Each Section is of 20 marks. Your Lab Records will carry 40 Marks (20 Marks for each section). 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.

Note: You must execute the program and submit the program logic, sample input and output along with the necessary documentation. Assumptions can be made wherever necessary.

Section-1

Q1: Implement the task scheduling algorithm on your system to minimize the total amount of time spent in the system for the following problem: **(10 Marks)**

• Job	*1*	*5*	*2*	*10*
• Service Time	3	7	4	8

Q2: Implement a recursive binary search algorithm on your system to search for a number 100 in the following array of integers: **(10 Marks)**

10 35 40 45 50 55 60 65 70 100

Show the processes step by step. Also, Draw recursive calls to be made in this problem

Section-2

Q1: Design a form for booking a room in the Hostel through an institutional website

The form should have the following fields:

First Name

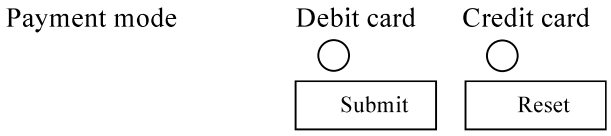
Last Name

email

Arrival Date

Departure Date

Country Select



- Use Java script to validate all the fields.
- Submit button should enter all the fields 'data to the database.
- Error message should be shown if a text field is left blank.
- Reset button resets all the fields to the blank.
- Design a check box for selecting payment mode.
- Design a drop down list for selecting a country field.

MASTER OF COMPUTER APPLICATIONS (MCA_NEW)

MCA_NEW 1st Semester Assignments

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MCSL-216	MCA_NEW(I)/L-216/Assignment/2026	30th April, 2026	31st October, 2026	14
MCSL-217	MCA_NEW(I)/L-217/Assignment/2026	30th April, 2026	31st October, 2026	16

Important Notes

1. Submit your assignments to the Coordinator of your Study Centre on or before the due date. Also, be in touch with concerned IGNOU RC for any updates regarding assignments schedule etc.
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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.

Course Code	**:**	**MCSL-217**
Course Title	**:**	**Software Engineering Lab**
Assignment Number	**:**	**MCA_NEW(I)/217/Assign/2026**
Maximum Marks	**:**	**100**
Weightage	**:**	**40%**
Last Dates for Submission	**:**	**30th April 2026 (for January session)** **31st October 2026 (for July 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 guideline regarding assignments given in the Programme Guide for the format of presentation.

Q1:

ABC is a network of Electronics stores across the Country. Also, ABC is having an online shop from where any electronic appliance can be bought which will be delivered at the address given by the Customer or delivery can also be taken from the store selected by the Customer. There is also provision to visit any store and also buy goods. Whenever, goods are bought online or at store in person, the software that consists of information about the quantity of appliance that is available will be reduced appropriately. Assume that you need to develop a software system that encompasses the above mentioned acativities.
Make assumptions, wherever necessary. Also, list them very clearly.

Now, with reference to the above, answer the following:

(1) List the Entities **(20 Marks)**
(2) For each Entity, list Attributes **(20 Marks)**
(3) Define relationships between the Entities **(20 Marks)**
(4) Finally, draw the Entity Relationship Diagram **(20 Marks)**