

Master's Degree in Computer Applications (M.C.A.)

CON/2215-06.

MCA Sem-III

(Sem-III) Object Oriented Programming

BB-6819

(3 Hours)

[Total Marks : 100

with C++

12-5-06

N.B. (1) Q.1 is Compulsory

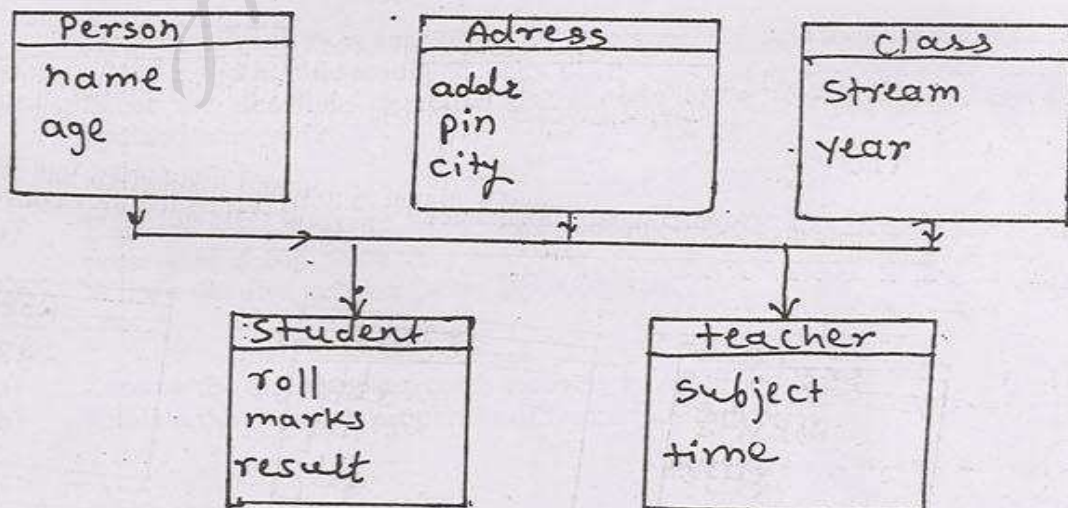
(2) Answer any four out of remaining six questions

(3) All Questions carry equal marks (20) and sub questions carry (10) marks

1. (a) What is virtual function? Why do we need virtual function? Explain with examples.
(b) Write a program to convert Date12 to Date24 class.
2. (a) How is a Polymorphism achieved at compile time and run time?
(b) Define a class prime, which has array of 10 numbers, the array holds the prime numbers. Write 0 and 1 argument constructor. The 0 argument constructor initializes the array by first 10 prime numbers. The 1 argument constructor initializes the array starting with the argument next prime numbers. Write function to display array.
3. (a) What is a function template? Write a function template to add squares of two given numbers.
(b) Write a program to simulate a calculator. Use most of the features of OOP language.
4. (a) Differentiate
 - i. Class and Object
 - ii. Container class and derived class
(b) How is an exception handled in C++? Explain with suitable example.
5. (a) Define and explain with suitable example
 - i. Operator overloading
 - ii. Function overloading
(b) Write a program to demonstrate Inheritance.
6. (a) Write a short note on 'STL'
(b) Define a class A which has private member variables n1, n2, n3, tot; avg; public member functions readdata(), displaydata(). To calculate total and average (use variable tot, avg respectively) what modifications should be done in class definition. Write a nonmember function to calculate total and average.
7. Write a short note (any four)
 - i. Copy constructor
 - ii. Error handling in file I/O
 - iii. Abstract class
 - iv. Inline function
 - v. UML diagram

- (1) Question no. 1 is compulsory.
- (2) Answer any four questions from Question Nos 2 to 7.
- (3) All Questions carry equal marks.

1. (a) What are the situations of data conversion? Explain. Give the solution of all situations with suitable example. 10
 (b) Explain the terms "call by value", "call by reference" and "call by pointers" with suitable examples. 10
2. (a) What is a class? What is an object? Define and explain the concepts of object oriented programming. 10
 (b) Write a program to define count class and overload ++ operator (both the versions prefix and postfix). 10
3. (a) "Inline function is a request to compiler and not a command." Comment. 10
 (b) Write a short note on STL. 10
4. (a) Compare and contrast static and reinterpret casting. 5X4
 (b) Compare and contrast constant function, constant argument and constant object.
 (c) Differentiate between function overloading and default arguments.
 (d) "C++ is free flow language." Comment.
5. (a) What is a friend function? Explain how friend function is useful in function overloading with suitable example. Explain Friend class. 10
 (b) Define an abstract class 'shape' with virtual function 'draw'. Derive the classes line, rectangle, circle and triangle from shape class to draw line, rectangle, circle and triangle respectively. Write a complete program to draw the different shapes dynamically as per the user need. 10
6. (a) Define and explain constructors. How to define the constructors in base and derived classes? In what order the constructors are called when creating an object of derived class? 10
 (b) Define the class string to implement 0, 1 and 2 argument constructors with functions strcmp, strstr, strcpy, strlen, and strdisplay. 10
7. (a) Define a class Queue and write main function to handle exceptions in Queue data structure. 10
 (b) Define the classes as per following class diagram. 10



Master's Degree in Computer Applications (M.C.A.)

Con. 1673-06. (Sem. III) Data Base Management Systems (REVISED COURSE) BB-6816

(3 Hours)

[Total Marks : 100

8-5-06

- N.B. (1) Question No. 1 is compulsory.
 (2) Answer any four from the remaining questions.

1. a) A university registrar's office maintains data about the following entities: (a) courses, including number, title, credits, syllabus, and prerequisites; (b) course offerings, including course number, year, semester, section number, instructor(s), timings, and classroom; (c) students, including student-id, name, and program; and (d) instructors, including identification number, name, department and title. Further, the enrollment of students in courses and grades awarded to students in each course they are enrolled for must be appropriately modeled. [12]

Construct an E-R diagram for the registrar's office. Document all assumptions that you make about the mapping constraints.

b) Write schema definition and all normalize all tables to 3NF for the above ER diagram [8]

2. Given the following Schema: [20]
 Supplier (S#, Sname, Scity, Turnover)
 Parts (P#, weight, color, cost, selling_price)
 Supply_Parts (S#, P#, quantity)

Write the following queries in SQL and Relational Algebra:

- i) Get the part numbers weighing between 25 and 35
- ii) Get the supplier names who are located in the city "Pune".
- iii) Get the names of suppliers who supply at least one part of red color.
- iv) Give the details of all suppliers from the city "Bombay" and turnover is more than Rs. 50 lacs.
- v) Get P# for the parts for which weight of the part is 5 kg and color is black.

3. a) What are functional dependencies? How do they help in removing redundancy from a DataBase design? [10]

b) Explain briefly about the DataBase System Architecture and Explain how it is different from the Conventional file system. [10]

4. a) How serializability is ensured in 2PL protocol? Discuss locks, granting of locks and implementing of locks. [10]

b) What are deadlock detection techniques? How can deadlocks be avoided/removed? [10]

5. a) Explain the terms Lossless join decomposition and Dependency preserving decomposition. [10]

b) Write a detailed note on Query Optimization [10]

6. a) Discuss the three steps in crash recovery in ARIES. [10]

b) Explain the desirable properties of Decomposition [10]

7. Write short note on (any 4): [20]

- i) Data Independence
- ii) ACID
- iii) Dynamic Hashing
- iv) WAL
- v) Database Administrator (DBA)

- N.B.** (1) Question No. 1 is compulsory.
 (2) Do any four from the remaining questions.

1. a) Draw an ER diagram appropriate for a system to manage a calendar of campus events. Consider each Event has a descriptive name. Every event has a single start date and time (when the event begins) and ending date and time. An event can be classified as athletic, social, religious, academic, or miscellaneous. Each event takes place at a specific venue on campus. A venue is either athletic (such as an athletic field), a lecture hall, a performance hall, or a public space. Events are sponsored by a particular campus group. Each campus group has a person who serves as a point of contact, and possibly also a web page. 12
- b) Write schema definition and all normalize all tables to 3NF for the above ER diagram 8
2. Using the scenario developed in question 1, Write Relational Algebra & SQL queries to answer the following questions: 20
- a) Find the Time and Venue details of the event "Lost in Space".
- b) What are all the athletic events that will take place on next Saturday?
- c) Do Semester II and Semester IV have any overlapping meetings?
- d) Are there any performance halls that are available tonight?
- e) Who are the points of contacts for all the groups who have social events in lecture halls this semester?
3. a) Multi-version 2PL combines features of 2PL and Multiversion concurrency control: updaters use locking to see the latest version of data, while read only transactions use old versions of data based on timestamps. Describe the scheme briefly 12
- b) What is lossy join decomposition? Give a small example including a relation instance and its decomposition 8
4. a) Outline the three conditions under which a redo is unnecessary during Recovery using ARIES. Describe an execution that illustrates any one of the conditions. 12
- b) Discuss the pros and cons of Hash join and sort merge join. 8
5. a) What normal form is the following relation in (only H,I can act as the key): 12
- STUFF (H, I, J, K, L, M, N, O)
- H, I → J, K, L
- J → M
- K → N
- L → O
- b) What are the important design decisions made in the System R Optimizer? 8
6. Differentiate between – 20
- a) Tuple and Domain Relational Calculus
- b) Strict 2PL and conservative 2PL
- c) Logical & Physical Data Independence
- d) B+ tree index vs ISAM index
7. Write short notes on (any four). 20
- i) SQL Query Block .
- ii) WAL .
- iii) Views .
- iv) Deadlock Detection .
- v) Minimal Closure .

NCA Sem. III

on. 1688-06.

Master's Degree in Computer Applications (MCA) (DCN) (Sem. III) Local Communication

2006

BB-6810

(3 Hours)

Networks

[Total Marks : 100

10-5-06

- N.B. (1) Question No. 1 is compulsory.
 (2) Attempt any four from question Nos. 2 to 7.
 (3) Assume suitable data wherever required.
 (4) State your assumptions clearly.
 (5) Answers to sub questions of any individual questions should be written together.
 (6) Use of pencil should be done only to draw diagrams and graphs.
 (7) Figures to right indicate marks.

- Q1 A) Why is it necessary to have a layered architecture for any communication model? Explain the OSI standard of communication. 10
 B) i) A line has a signal to noise ratio of 1000 and a bandwidth of 400KHz. What is the maximum data rate supported by this line? 5
 ii) Calculate the CRC for the following bit stream: 1101011011 with the generator bit stream 10011. 5
- Q2 A) What is multiplexing? Explain FDM with the help of a diagram. Find the minimum bandwidth for each path given the following information 10
 1. FDM multiplexing
 2. 5 lines each requiring 4000 Hz
 3. 200-hz guard band
 B) Explain three way hand-shake as used in TCP connection 10
- Q3 A) Explain Distance Vector with a suitable example 10
 B) What is fragmentation? Why is it required? How is it done? 10
- Q4 A) Distinguish between circuit switching, packet switching and message switching 10
 B) Discuss the guided transmission media 10
- Q5 A) Discuss the IEEE 802.3 10
 B) i) Calculate the LRC and VRC for the following bit pattern using odd parity 5
 1001100 1010100 1100110 1110001
 ii) Distinguish between LAN, MAN and WAN 5
- Q6 A) Explain the use of hub, router switch and repeater in networking. In which layer of the network model are each of them used. 10
 B) What is flow control? Explain the sliding window protocol used for flow control 10
- Q7 A) Write short notes on any four of the following 20
 1. SMTP 2. MIME
 3. DES 4. Network Topology
 5. HDLC

on. 4904-05.

(3 Hours)

BB-6458
[Total Marks : 100

- N.B. (1) Question No. 1 is compulsory.
 (2) Attempt any **four** out of the remaining **six** questions.
 (3) Assumptions made should be clearly stated and justify the **same**.
 (4) **Figures** to the **right** indicate marks.
 (5) Answer to the questions should be **grouped** and written **together**.

1. (a) Distinguish between circuit switching, packet switching and message switching. 10
 (b) Three packet switching networks each contains n nodes. The first network has a star topology with a central switch, the second is fully interconnected, with a wire from every node to every other node. What are the best, average and worst case transmission paths in hops ? 10

2. (a) What is the relationship between the transport layer and the upper OSI layers. 10
 (b) (i) A signal is sampled. Each sample requires at least 12 levels of precision (+ 0 to + 5 and - 0 to - 5). How many bits should be sent for each sample. 5
 (ii) To digitize human voice, what is the bit rate assuming eight bits per sample. 5

3. (a) Explain the following in detail : 10
 (i) Distance vector routing algorithm (ii) Link state routing algorithm. 10
 (b) What is the destination physical address in an IP ARP request packet for device 192.168.44.64 ? 10

4. (a) (i) Describe the difference between S-ALOHA and R-ALOHA. 10
 (ii) Construct the hamming code for the bit sequence 10011101. 5
 (b) Calculate the VRC and LRC for the following bit pattern using even parity. 5
 0011101 1100111 1111111000000

5. (a) What are the four types of redundancy checks used in data communication ? 10
 (b) Discuss VRC and the types of errors it can and cannot detect. How is VRC related to LRC ? 10

6. (a) What are the two types of TDM ? How is WDM similar to FDM and two are they different ? 10
 (b) Relate the TCP/IP application layer to its OSI model equivalent. 10

7. Write short notes on (any four) :— 20

(i) HDLC	(iv) Leaky Bucket algorithm
(ii) PAM, PWM and PCM	(v) CDMA vs TDMA and FDMA
(iii) OSI Reference Model	(vi) Transmission Media.

MCA Sem-III

on. 1683-06.

Master's Degree in Computer Applications (M.C.A.)
(Sem. III) Technical Writing and
Organisational (3 Hours) Behaviour

18/5/2006
BB-6822

[Total Marks : 100

18-5-06

N.B. (1) Question No. 1 is compulsory.

(2) Attempt any two from question Nos. 2 to 4.

(3) Attempt any two from question Nos. 5 to 7.

(4) Attempt the question from OB and TW separately.

(5) All questions carry equal marks.

1. (a) Explain the following concepts and terms as used in organisational behaviour (Attempt any five) :— 10
 - (i) Decision making
 - (ii) Values
 - (iii) Groups
 - (iv) Team
 - (v) Perception
 - (vi) Conflict
- (b) Define and explain the term report and state the characteristics of a good report. 10
2. (a) Describe the various leadership styles. 10
- (b) What do you understand by attitudes? What are their functions? 10
3. (a) Define the term stress. What are its sources? 10
- (b) Explain the three ego states and the three major transactions described in Transactional Analysis. 10
4. (a) "Counselling seeks to improve mental health". Explain. 10
- (b) What is stereotyping and halo effect of social perception? 10
5. (a) A survey indicates that students on campus needs counselling regarding the studies, pre-examination stress, choosing career and sometimes personal. As student secretary of your institute discuss this matter with your staff incharge and make a proposal to set up counselling and guidance cell in your campus. 15
- (b) Explain the importance in oral presentation and when they have to be distributed. 5
6. (a) As a computer lab incharge you have been instructed by the management of the institute to replace the existing old equipment like printers, computers, C.D. writers and operating system. You need to consult with various companies present in the market with these competitive cost and their post sales service and the required time to supply. Present your findings, recommendations and conclusion in the memorandum form. 15
- (b) Write a short notes (any two) :— 5
 - (i) Glossary
 - (ii) Table of content
 - (iii) Letter of transmit
7. (a) What are the characteristics of a good software requirements specifications? 10
- (b) You are the secretary of the student council of your institute prepare a notice with an agenda calling a meeting to discuss the following :— 10
 - (i) Introduction of book bank facility.
 - (ii) A representation to BEST to provide a request stop near the institute.
 - (iii) Suggestions to improve sports and canteen facilities.

Prepare the minutes assuming the meeting to be over.

- N.B. (1) Question No. 1 is compulsory.
 (2) Attempt any two from Question Nos. 2 to 4.
 (3) Attempt any two from Question Nos. 5 to 7.
 (4) Attempt the questions from O.B. and T.W. separately.
 (5) All questions carry equal marks.

- Q1.(a) Explain following concepts and terms as used in organizational behaviour
 (Attempt any five)- (10)
- | | |
|--------------------------------|--------------------|
| (i) McClelland Theory of Needs | (ii) Self Efficacy |
| (iii) Brain Storming | (iv) Counselling |
| (v) Conflict | (vi) Halo Effect. |
- (b) Question from Technical Writing - (10)
 Write set of instructions that helps a customer burn a CD. The customer should be able to burn the CD using Nero Express. Please assume that this booklet is for those people who are technologically challenged and are taking up this task for the first time.
- Q2 a) How is stress defined ? Discuss how stress and job performance are related.
 Is stress helping or interfering with your performance in college ? Discuss. (10)
- b) Define Personality .
 'Heredity determines Personality '
 (i) Build an argument to support this statement (10)
 (ii) Build an argument against this statement
- Q3. Define Learning . Contrast Classical conditioning, Operant conditioning and Social Learning. (20)
- Q4 a) . Define Perception. What is Attribution Theory ? What are its implications for explaining organisational behaviour ?
 Give some positive results of using shortcuts when judging others. (10)
 b) Describe the steps involved in optimizing model of decision making. (10)
- Q5 a) A meeting has been convened in the office of the Director of your Institute. This meeting is to discuss the feasibility of organising a "Technical Festival" in your College. One section of the members attending the meeting feels that organising such Festivals is a bad idea as it interrupts the teaching schedules. Another section believes that these "Festivals" are good because they inculcate a sense of responsibility in students. (10)
 Assume that you are the student representative at the meeting. You need to write down the detailed minutes of the same and submit them to your Director.
- b) What are the methods used to express Software Requirements? (10)
- Q6a) Assume that you are an enthusiastic MCA graduate who wants to set up shop on his own. You have looked at the various business avenues that can be explored and feel that software for the mobile content and gaming industry is going to be the next blockbuster business application. (10)
 However to set up an organization that is able to meet the exacting requirements of the mobile gaming industry you would require a lot of capital. To generate this investment you need to prepare a detailed business proposal that can be submitted to a venture capitalist.
 Note: Venture Capital is capital provided for new concerns by those other than the original proprietor. Venture capitalists often insist on a share of the equity of the new concern in return for their capital.
- b) What is your understanding about 7C's of Communication. (10)
- Q7 a) Assume you are a programmer in a firm that specialises in software for the retail sector. You have been teamed with a certain marketing manager and are expected to attend meetings with prospective clients along with him. You find that he is invariably late for all the meetings that have been set up. This unprofessional conduct, as expected, leaves a very bad impression on the clients. Some of the clients have even asked you point blank if your company is interested in doing business with them at all. Write a memo to the head of marketing explaining the problems that you are facing. (10)
- b) How, in your opinion, should the documentation of a meeting take place? (10)

Master's Degree in Computer Applications (M.C.A.)

on. 1678-06. (Sem - III) Optimization Techniques
 MCA Sem-III

2006

BB-6813

(3 Hours)

[Total Marks : 100

- N.B. (1) Question No. 1 is compulsory.
 (2) Attempt any four out of remaining six questions.
 (3) Assume any necessary data but justify the same.
 (4) Figures to the right indicate marks.
 (5) Use of calculator is allowed.

16-5-06

1. a) A diet conscious housewife wishes to ensure certain minimum intake of vitamins A, B and C for the family. The minimum daily (quantity) needs of the vitamins A, B, C for the family are respectively 30, 20, and 16 units. For the supply of these minimum vitamin requirements, the housewife relies on two fresh foods. The first one provides 7, 5, 2 units of the three vitamins per gram respectively and the second one provides 2, 4, 8 units of the same three vitamins per gram of the foodstuff respectively. The first foodstuff costs Rs. 3 per gram and the second Rs. 2 per gram. The problem is how many grams of each foodstuff should the housewife buy everyday to keep her food bill as low as possible? Formulate the underlying L.P. problem and solve graphically. [10]

b) The following is the activity list of a project with time estimates. [10]

Activity	Time optimistic	Most likely	Pessimistic
1-2 (A)	6	6	24
1-3 (B)	6	12	18
1-4 (C)	12	12	30
2-5 (D)	6	6	6
3-5 (E)	12	30	48
4-6 (F)	12	30	42
5-6 (G)	18	30	54

- (i) Draw a network.
 (ii) Find expected duration and variance for each activity.

2. a) Solve using Simplex method. [10]

Maximize: $z = 10x_1 + 6x_2 + 4x_3$
 Subject to: $x_1 + x_2 + x_3 \leq 100$
 $10x_1 + 4x_2 + 5x_3 \leq 600$
 $2x_1 + 2x_2 + 6x_3 \leq 300$
 $x_1, x_2, x_3 \geq 0$.

b) Find the initial basic feasible solution using VAM for the following transportation Problem. [10]

		Distribution Centre				Supply
		A	B	C	D	
Plant	1	2	3	11	7	6
	2	1	0	6	1	1
	3	5	8	15	9	10
Requirement		7	5	3	2	

3. a) Solve the following using big M method. [10]

Minimize: $z = 4x_1 + x_2$
 Subject to: $3x_1 + 4x_2 \geq 20$
 $x_1 + 5x_2 \geq 15$
 $x_1, x_2 \geq 0$.

[TURN OVER

b) An airline has drawn up a new flight schedule involving five flights. To assist in allocating five pilots to the flights, they have asked them to state their preference scores by giving each flight a number out of 10. The higher the number the greater the preference is. Certain of these flights are unsuitable to some pilots due to domestic problems. These are marked with an (X). [10]

Pilot	Flight No.				
	1	2	3	4	5
A	8	2	X	5	4
B	10	9	2	8	4
Men C	5	4	9	6	X
D	3	6	2	8	7
E	5	6	10	4	3

What should be the allocation of the pilots to flights in order to meet as many preferences as possible?

4. a) Solve the following problem by dual simplex method. [10]

Minimize: $z = x_1 + 2x_2 + 3x_3$
 Subject to: $2x_1 - x_2 + x_3 \geq 4$
 $x_1 + x_2 + 2x_3 \leq 8$
 $x_2 - x_3 \geq 2$
 $x_1, x_2, x_3 \geq 0$

b) A machine operator has to perform three operations; turning, threading, and kurling on a number of different jobs. The time required to perform these operations (in minutes) for each job is known. Determine the order in which the jobs should be processed in order to minimize the total time required to turn out all the jobs. [10]

Job	Time for turning (min)	Time for threading (min)	Time for kurling (min)
1	3	8	13
2	12	6	14
3	5	4	9
4	2	6	12
5	9	3	8
6	11	1	13

5. a) Use revised simplex method to solve the following. [15]

Maximize $Z = 4x_1 + 3x_2$
 Subject to: $3x_1 + 4x_2 \leq 12$
 $3x_1 + 3x_2 \leq 10$
 $4x_1 + 2x_2 \leq 8$
 $x_1, x_2 \geq 0$

b) Write the dual of the following LPP. [5]

Maximize: $z = 8x_1 + 2x_2 + 5x_3$
 Subject to: $3x_1 - 2x_2 + 5x_3 \leq 40$
 $x_1 + 7x_2 - 4x_3 \leq 20$
 $5x_1 - 2x_3 \geq 12$
 $x_1, x_2 \geq 0, x_3$ is unrestricted in sign.

6. a) Find the optimal strategies and value of the game where pay-off matrix of the two player is given by [10]

	B ₁	B ₂	B ₃
A ₁	2	6	1
A ₂	8	4	6
A ₃	1	2	1

b) The Simple Engineering Company has a machine whose purchase price is Rs. 80,000. The expected maintenance costs and resale price in different years are given here

Year	1	2	3	4	5	6	7
Maintenance costs (Rs)	1000	1200	1600	2400	3000	3900	5000
Resale Value (000 Rs.)	75	72	70	65	58	50	45

At what time interval in your opinion, should the machine be replaced? [10]

7. a) A project is composed of 7 activities whose time estimates are given in the table below:- [10]

Activity i-j	Estimated duration in weeks		
	Optimistic	Most Likely	Pessimistic
1-2	1	1	7
1-3	1	4	7
1-4	2	2	8
2-5	1	1	1
3-5	2	5	14
4-6	2	5	8
5-6	3	6	15

Determine the total float, free float and independent float of each activity.

b) Explain the following:

- (i) Gomory's constraint in integer programming.
- (ii) Infeasible solution.
- (iii) Saddle point.
- (iv) Traveling salesman problem.

[10]

-----X-----X-----

- N.B. (1) Attempt any five questions.
 (2) Figures to the right indicates marks.

1. (a) Consider two different type of food stuffs say F_1 and F_2 . Assume that these food stuffs contain vitamin V_1, V_2 and V_3 . Minimum daily requirements of these vitamin are 1 mg of V_1 , 50 mg of V_2 and 10 mg of V_3 . Suppose that F_1 contains 1 mg. of V_1 , 100 mg of V_2 and 10 mg of V_3 whereas F_2 contains 1 mg of V_1 , 10 mg of V_2 and 100 mg of V_3 . Cost of one unit of F_1 is Re. 1 and that of F_2 is Rs. 1-50. Find the minimum cost diet that would supply the body at least the minimum requirement of each vitamin. 10
- (b) For the following data :— 10
- (i) Draw the network
 - (ii) Identify the critical path,
 - (iii) Find the normal duration and the corresponding cost
 - (iv) Find the optimum duration and the corresponding minimum cost.

Activity	Normal		Crash	
	Time	Cost	Time	Cost
1—2	3	50	2	100
1—3	2	75	1	150
1—4	6	140	4	260
2—4	5	100	3	180
2—5	7	115	5	145
3—4	2	80	2	80
4—5	4	100	2	240

Indirect cost is Rs. 90/- per day.

2. (a) Solve the following problem using simplex method. 10
- Maximize $z = 107x_1 + x_2 + 2x_3$
- Sub. to $\frac{14}{3}x_1 + \frac{1}{3}x_2 - 2x_3 + x_4 = 7$
- $16x_1 + \frac{1}{2}x_2 - 6x_3 \leq 5$
- $3x_1 - x_2 - x_3 < 0$
- $x_1, x_2, x_3, x_4 \geq 0.$

- (b) Obtain an optimum basic feasible solution to the following transportation problem. 10

		Warehouse				a_i
		W_1	W_2	W_3	W_4	
Factory	F_1	19	30	50	10	7
	F_2	70	30	40	60	9
	F_3	40	8	70	20	18
	b_j	5	8	7	14	

3. (a) Use Two-phase Simplex method to solve the following problem and comment. 10
- Maximize $z = 3x_1 + 2x_2$
- Sub. to $2x_1 + x_2 < 2$
- $3x_1 + 4x_2 < 12$
- $x_1, x_2 \geq 0$

- (b) Five men are available to do five different jobs. From past records the time (in hrs.) that each man takes to do each job is known and is given in the following table :— 10

		Jobs				
		1	2	3	4	5
Man	1	2	9	2	7	1
	2	6	8	7	6	1
	3	4	6	5	3	1
	4	4	2	7	3	1
	5	5	3	9	5	1

Find the assignment of men to jobs that will minimise the total time taken.

4. (a) Use dual Simplex method to solve the following problem— 10
 Minimize $z = 6x_1 + 7x_2 + 3x_3 + 5x_4$
 Sub. to $5x_1 + 6x_2 - 3x_3 + 4x_4 \geq 12$
 $x_2 + 5x_3 - 6x_4 \geq 10$
 $2x_1 + 5x_2 + x_3 + x_4 \geq 8$
 $x_1, x_2, x_3, x_4 \geq 0$
- (b) Find the sequence for the following 8 jobs, that will minimise the total elapsed time for the completion of all jobs. Each job is processes in the order CAB. 10

Job

	1	2	3	4	5	6	7	8
A ₁	4	6	7	4	5	3	6	2
B ₁	8	10	7	8	11	8	9	13
C ₁	5	6	2	3	4	9	15	11

5. (a) Use Revised Simplex method to solve the following problem— 10
 Maximise $z = 2x_1 + x_2$
 Sub. to $3x_1 + 4x_2 \leq 6$
 $6x_1 + x_2 \leq 3$
 $x_1, x_2 \geq 0$
- (b) Use dominance property to reduce the following game to 2 × 2 game and hence find the optimal strategies and the value of the game. 10

B

A	$\begin{bmatrix} 3 & -2 & 4 \\ -1 & 4 & 2 \\ 2 & 2 & 6 \end{bmatrix}$
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6. (a) Define the following terms :— 10
 (i) Competitive game (ii) Pure strategy (iii) Mixed strategy (iv) Two person zero sum game.
- (b) A truck owner finds from his past records that the maintenance cost per year of a truck whose purchase price is Rs. 8,000 are as given below :— 10

Year	1	2	3	4	5	6	7	8
Maintenance cost (Rs.)	1,000	1,300	1,700	2,200	2,900	3,800	4,800	6,000
Resale price (Rs.)	4,000	2,000	1,200	600	500	400	400	400

Determine at which time it is profitable to replace the truck.

7. (a) A small assembly plant assembles PCS through 9 interlinked stages according to following precedence process :— 10

Activity	1-2	1-3	1-4	2-4	2-5	3-6	4-6	5-7	6-7	6-8	7-8	8-9
Duration	4	12	10	8	6	8	10	10	0	8	10	6

- (i) Draw a network and find a critical path
 (ii) Tabulate total float, free float and independent float.
- (b) The maintenance engineer for a large construction company is examining alternatives open to him for the replacement of hydraulic hoses in the firm's 100 front-end loaders, each loader uses six hoses, which from historical maintenance records fail at this rate. 10

Month of use	1	2	3	4	5
% Requiring replacement by that month	10	15	20	70	100

The engineer learns that "in the field" replacement costs Rs. 80 per hose while it costs only Rs. 40 per hose if all the hoses are replaced at regular interval during routine maintenance and service. Evaluate the alternatives open to this engineer and recommend a course of action.