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FIFTH SEMESTER

Roll No.: L511 | M.C.J.
B.Tech.

END SEMESTER EXAMINATION

(Nov.-Dec., 2013)

MC-301, Modern Algebra

Time: 3 Hours

Max. Marks: 70

Note: Attempt all the questions by selecting any two parts from each question.
All questions carry equal marks.

~~(x)~~ (a) Define Klein 4-group. Let G be a group and $a, b \in G$, then show that the equations $ax = b$ and $ya = b$, have unique solutions in G .

~~(x)~~ Define a cyclic group with an example and show that every subgroup of a cyclic group is cyclic. $H = \langle a^m \rangle$ *represents the least*

~~(x)~~ (c) Define normal subgroup with an example and show that if H is a normal subgroup in G iff $xH = Hx$, for each $x \in G$.

~~(x)~~ (a) Define group isomorphism with an example. Show that any group of order 4 is abelian.

~~(x)~~ (b) State and prove first fundamental theorem of group isomorphism.

~~(x)~~ (c) Define alternating group with an example. State and prove Cayley's theorem.

~~(x)~~ (a) Define an integral domain with an example and show that every finite integral domain is a field.

~~(x)~~ (b) Define a regular element of a ring R with 1 and provide an example. If $R = \{a + b\sqrt{-5}\}$ then determine the regular elements of R .

~~(x)~~ (c) State and prove second fundamental theorem of Ring homomorphism.

~~(x)~~ (a) Define simple ring with an example. If R is a commutative simple ring with 1 then show that it is a field.

(b) Define prime ideal with an example and show that if P is a prime ideal of \mathbb{Z} iff either $P = 0$ or $P = p\mathbb{Z}$ for some prime p .

~~(x)~~ (c) Define Maximal ideal with an example. Let R be a commutative ring with 1. Show that an ideal M is a maximal ideal iff R/M is a field.

~~(x)~~ (a) State and prove imbedding theorem.

~~(x)~~ (b) Define Euclidean domain with an example and show that every ideal of an Euclidean domain is principal ideal.

(c) Define unique factorization domain with an example. If R is a UFD then show that any two elements of R have a gcd.

End Semester (2013)
 B.Tech V Semester(Mathematics and Computing)
 Course Name : Operations Research
 Max Marks: 70

Total No. of pages-4
 Roll No.....
 Course Code: MC-302
 Time: 3 Hours

Note:1. Attempt any seven questions. Each question carry equal marks.
2. Assume missing data, if any.

Q 1. (a) A 24-hour supermarket has the following minimal requirement for the cashiers:

Period	1	2	3	4	5	6
Time of day(24 - hr - clock)	3-7	7-11	11-15	15-19	19-23	23-3
Minimum No.	7	20	14	20	10	5

Period 1 follows immediately after period 6. A cashier works 8 consecutive hours, starting at the beginning of one of the six periods. Determine a daily employee worksheet which satisfies the requirement with the least number of personnel.

(b) Solve the given Linear Programming Problem graphically

$$MaxZ = 7x_1 + 3x_2$$

subject to :

$$x_1 + 2x_2 \geq 3$$

$$x_1 + x_2 \leq 4$$

$$x_1 \leq 5/2$$

$$x_2 \leq 3/2$$

$$x_1, x_2 \geq 0.$$

Q 2. Consider the following Linear Programming Problem:

$$MaxZ = 4x_1 + 5x_2 - 3x_3 + 100$$

subject to :

$$x_1 + x_2 + x_3 = 10$$

$$x_1 - x_2 \geq 1$$

$$2x_1 + 3x_2 + x_3 \leq 40$$

$$x_1, x_3 \geq 0.$$

(a) Write the dual of the above problem.

(b) Solve the above problem by simplex method.

(c) Give the solution of dual also.

Q 3. The following table gives the cost for transporting material from supply point A, B, C and D to demand point E, F, G, H, I and J.

<i>Supply Point ↓ Demand point →</i>	<i>E</i>	<i>F</i>	<i>G</i>	<i>H</i>	<i>I</i>	<i>J</i>	<i>availability ↓</i>
<i>A</i>	9	12	9	6	9	10	5
<i>B</i>	7	3	7	7	5	5	6
<i>C</i>	6	5	9	12	3	11	2
<i>D</i>	6	8	11	2	2	10	9
<i>Requirement →</i>	4	4	6	2	4	2	

- (a) Find the initial basic feasible solution to the above Transportation Problem by Vogal Approximation Method(VAM).
- (b) Check if the solution is optimal. If not find an optimal solution.

Q 4. Solve the following Integer Programming problem

$$Max z = 2x_1 + x_2$$

subject to :

$$x_1 + x_2 \leq 5$$

$$6x_1 + 2x_2 \leq 21$$

$$x_1, x_2 \geq 0$$

x_1 and x_2 are integers.

Q 5. A multi-plant organization has three plants A, B, C and Three market places X, Y ,Z. The item from the plants are transported to the market places through two intermediate-finished goods warehouses W_1 and W_2 . The details on cost of transportation per unit for different combinations between the plants and warehouses, between warehouses and market, between warehouses, supply values of the plants and demand values of the markets are summarized in the following table:

<i>Source ↓ Destination →</i>	<i>X</i>	<i>Y</i>	<i>Z</i>	<i>W₁</i>	<i>W₂</i>	<i>Supply</i>
<i>A</i>	∞	∞	∞	25	40	400
<i>B</i>	∞	∞	∞	38	20	500
<i>C</i>	∞	∞	∞	40	25	600
<i>W₁</i>	20	45	25	0	25	-
<i>W₂</i>	30	20	40	40	0	-
<i>Demand</i>	300	700	500	-	-	

Q 6. Suppose that there are six people applying for 5 jobs; and it is desired to fill each job with exactly one person. The costs for filling the jobs with six people are given in the following table.

<i>People ↓ Jobs →</i>	<i>J₁</i>	<i>J₂</i>	<i>J₃</i>	<i>J₄</i>	<i>J₅</i>
<i>P₁</i>	27	23	22	24	27
<i>P₂</i>	28	27	21	26	24
<i>P₃</i>	28	26	24	25	28
<i>P₄</i>	27	25	21	24	24
<i>P₅</i>	25	20	23	26	26
<i>P₆</i>	26	21	21	24	27

Determine the optimal assignment plan, i.e. the plan whereby the cost of assigning the people is minimized.

~~Q.7.~~ Consider the following Linear Programming problem

$$Maxz = 3x_1 + 5x_2$$

subject to :

$$2x_1 + 3x_2 \leq 24$$

$$x_1 \leq 9$$

$$x_2 \leq 6$$

$$x_1, x_2 \geq 0$$

(a) Solve the given LPP.

(b) Discuss the case of sensitivity analysis if the objective function is changed to

$$Maxz = 4x_1 + 5x_2$$

~~Q.8.~~ A manufacturing Company is considering the construction of a new factory building. The following list shows the project activities, precedence relationship and time estimates

<i>Activity</i>	<i>Description</i>	<i>Immediate predecessor</i>	<i>Time</i>
A	Problem Definition	-	3
B	Preliminary Study of Cost and constraints	A	3
C	Analysis of problems in existing building	A	3
D	Incorporation of requirements in new building	C	5
E	Detailed drawing of new building	B, C	6
F	Contractor building a prototype	D, E	9
G	Cost analysis	E	5
H	Engineers reviewing feasibility	G	3
I	Contractor building the factory	G, F	5
J	Building inspection	I, H	6
K	Final plan layout	J	4

(a) Develop a CPM network for this project.

(b) Identify the critical path

Q 9. The project of constructing a small bridge in Wilmington, Pennsylvania consists of 10 major activities. Information pertaining to the project is given below:

<i>Activity</i>	<i>Optimistic(a)</i>	<i>MostLikely(m)</i>	<i>Pessimistic(b)</i>
<i>A</i>	2	5	8
<i>B</i>	4	7	10
<i>C</i>	4	9	14
<i>D</i>	6	10	20
<i>E</i>	1	3	5
<i>F</i>	3	6	9
<i>G</i>	4	5	12
<i>H</i>	6	8	10

- (a) Develop a PERT network for this project.
- (b) Identify the critical path.
- (c) Compute the probability of completing the project in 29 weeks.

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5th SEMESTER

END SEMESTER EXAMINATION

Roll No. 2011/MC/012

B.Tech (MC- Engg.)

Nov 2013

MC – 303 Financial Engineering

Time : 3 hrs

Max. Marks: 70

Note: Q.No.1 is compulsory, answer any other three questions.

Statistical table is allowed. Assume missing data , if any.

1. (a) The current price of silver is \$15 per ounce. The storage costs are \$0.24 per ounce per year payable quarterly in advance. Assuming that interest rates are 10% per annum for all maturities, calculate the futures price of silver for delivery in nine months. 4
- (b) A stock price is currently \$50. Assume that the expected return from the stock is 18% per annum and its volatility is 30% per annum. What is the probability distribution for the stock price in two years? Calculate the mean and standard deviation of the distribution. Determine the 95% confidence interval. 6
- (c) Consider a portfolio of two assets a_1 & a_2 with the following statistical parameters $\mu_1 = 5\%$, $\mu_2 = 10\%$, $\sigma_1 = 10\%$, $\sigma_2 = 40\%$, $\rho_{12} = -0.05$. Find the value of minimum risk, the expected return and weight of the assets. 6
- (d) The stock price is Rs.260. A 6-month European call option on the stock with strike price Rs.256 is priced using Black-Scholes formula. It is given that the continuously compounding risk free rate is 4%, stock pays no dividend. The volatility of the stock is 25%. Determine the price of call and put options. 6
- (e) Evaluate the integral $\int_0^T W(t) dW(t)$ using the Ito-Doeblin formula. 6
2. (a) Obtain Cox-Ross-Rubinstein (CRR) formula for European option pricing for binomial approximation. 7
- (b) Let $S(0) = 120$ dollars, $u = 0.2$, $d = -0.1$ and $r = 0.1$. Consider a call option with strike price $X = 120$ dollars and exercise time $T = 2$. Find the option price and the replicating strategy. 7

3. (a) Prove that $W^2(t) - t, t \geq 0$ is a Martingale, where $\{W(t), t \geq 0\}$ is a Brownian motion. 7

(b) Let $S(t)$, stock price at time t , satisfy the stochastic d.e. 7

$dS(t) = \mu S(t)dt + \sigma S(t)dW(t)$, find the strong solution of $S(t)$.

4. (a) If $S(0)$ is the price of asset at $t=0$, then prove that the forward price will be 7

$$F(0, T) = \frac{S(0)}{d(0, T)}$$

$d(0, T)$ is the discount factor between $t=0$ to $t=T$.

Let $A(0) = 100, A(1) = 110, S(0) = 100$ dollars and 7

~~$S(1) = \begin{cases} 120 & \text{with probability } p \\ 80 & \text{with probability } 1-p \end{cases}$~~ find call and put option

price.

5. (a) Prove that portfolio with minimum risk has weights given by 7

$$W = \frac{C^{-1}e}{e^T C^{-1}e}$$

where C is variance and covariance matrix, and $e^T = (1, 1, \dots, 1) \in \mathbb{R}^n$.

(b) Using the following data for two assets:

Scenario	Probability	Return K_1	Return K_2
ω_1 (recession)	0.4	-10%	20%
ω_2 (stagnation)	0.2	0%	20%
ω_3 (boom)	0.4	20%	10%

Find the weights in a portfolio with expected return $\mu_v = 46\%$ and compute the risk of this portfolio.

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5TH SEMESTER
END SEMESTER EXAMINATION

Roll No.....
B.Tech.(MC)
(NOVEMBER – 2013)

MC-304 - INTERNET AND NETWORK SECURITY

Time: 3:00 Hours

Max. Marks: 70

Note: Answer any 5 questions. Assume suitable value for any missing data.

- ~~Q1-~~ (a) For n devices in a network, what is the number of cable links required for a mesh, ring, bus and star topology?
(b) Compare and contrast between two approaches to packet switching. (6+8=14)
- ~~Q2-~~ (a) What is Playfair cipher? Explain its rules for encryption .Encrypt the plain text “hello spoofing attack” using key word “computer”.
(b) Determine the multiplicative inverse of $1234 \text{ MOD } 4321$ using extended Euclid algorithm. (7+7=14)
- ~~Q3-~~ (a) Describe briefly the Hill cipher. Find out the Message from cipher text “SLHZYATGZT” using key $\begin{pmatrix} 9 & 4 \\ 5 & 7 \end{pmatrix}$.
(b) What is permutation cipher. For a permutation cipher key (3,7,2,6,1,8,5,4) compute the decryption key. (7+7=14) .
- ~~Q4-~~ (a) Define various attack on RSA. Encrypt the message “M”=18, While $p=5, q=11$ and encryption key = 7. Compute decryption key for this setup and prove its correctness.
(b) Compute Euler's Totient function for following: 165, 1716, 180, 351. (6+8=14)

Q5- ~~(a)~~ In a Diffie-Hellman key exchange algorithm, let prime no $p= 23$ and base(root) $g=7$. Let A and B select their secret key $X_a=6$, and $X_b=15$. Compute

- ~~(i)~~ Public key of A and B
- ~~(ii)~~ Common secret key (if any)

~~(b)~~ Explain Man in middle attack in Diffie hellman key exchange algorithm with extending the setup given in part(a) above.

(7+7=14)

~~(a)~~ (a) Describe how authentication header(AH) is used in Transport and tunnel mode in IPsec Protocol.

(b) Explain Encapsulating Security Payload(ESP). (6+8=14)

~~(a)~~ Q7- Write short note of any 4

- ~~(a)~~ HMAC
- ~~(c)~~ Digital Signature
- ~~(e)~~ Kerberos version 4.
- ~~(b)~~ X.509 Certificate
- ~~(d)~~ Firewall
- ~~(f)~~ SET Protocol

(4x3.5=14)

~~(a)~~ Q8- Differentiate between

- (a) Confusion and diffusion
- (b) Double DES and Triple DES
- (c) Substitution and Transposition ciphers
- (d) Block cipher and Stream cipher.
- (e) Cryptography and Cryptology
- (f) IPv4 and IPv6
- (g) Program virus and Macro virus

(7x2=14)

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FIFTH SEM

Roll No:.....

B.TECH(MC)

END SEMESTER EXAMINATION

NOVEMBER 2013

MC-305 DATABASE MANAGEMENT SYSTEM

Time: 3 Hours

Max. Marks : 70

Note : Answer any five

Assume suitable missing data, if any.

~~Q1.~~ (a) Define the terms : Entity, Entity set, Primary key, Database Schema, Instance, DDL, Starvation, Dead lock, Hashing 9

(b) Describe the three levels of data abstraction? What is Data Independence? 5

~~Q2.~~ (a) Design an ER diagram for an IT training group database that will meet the information needs for its training program. Clearly indicate the entities, relationships and the key constraints. The description of the environment is as follows :

The company has 12 instructors and can handle upto 100 trainees for each training session. The company offers 5 Advanced technology courses, each of which is taught by a team of 2 or more instructors Each instructor is assigned to a maximum of two teaching teams or may be assigned to do research Each trainee undertakes one Advanced technology course per training session. 9

(b) What is embedded SQL? What are the advantages of embedded SQL programs? Give example 5

~~Q3.~~ (a) Explain various recovery techniques during transaction in detail. 9

~~b~~ (b) What are the ACID properties of a transaction? Explain using suitable example. 5

~~Q5.~~ (a) What is concurrent control? How is it implemented in DBMS? Explain. 6

(b) What is DBMS? Explain the architecture of DBMS. 8

Q4(a) Justify the need of normalization with examples. What is FD? Explain the role of FD in the process of normalization. 7

(b) Examine the table shown below : 2,3,2

Staff No.	Branch No.	Branch Address	Name	Position	Hrs/Week
E101	B02	Sun Plaza, Delhi, 110001	Ram	Assistant	16
E101	B04	2/3 UT, Delhi, 110111	Ram	Assistant	9
E122	B02	Sun Plaza, Delhi, 110001	Mohan	Assistant	14
E122	B04	2/3 UT, Delhi, 110111	Mohan	Assistant	10

(i) Why is the table above not in 2NF?

(ii) Describe the process of normalizing the data shown in the table above to third normal form (3NF).

(iii) Identify the primary and foreign keys in your 3NF relations.

Q6(a) What is the purpose of Trigger and Assertion constraints? How these are implemented. Give examples. 6

(b) Consider the following relations : 8

Employee (emplID, FirstName, LastName, address, DOB, sex, position, deptNo)

Department (dtptNo, deptName, mgr, empID)

Project (projNo, projName, deptNo)

Work on (empID, projNo, hours worked)

Write the SQL statements for the following:

- List the name and addresses of all employees who work for the IT department.
- List the total hours worked by each employee, arranged in order of department number and within department, alphabetically by employee surname.
- List the total number of employees in each department for those departments with more than 10 employees.
- List the project number, project name and the number of employees who work on that project.

Q7 Write Short Notes (any two) 14

- Relational Algebra
- Serializability
- B+ Index file