

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

- (1) (a) Define an abelian group with an example. Let G be a group in which
- $$(ab)^3 = a^3b^3$$
- $$(ab)^5 = a^5b^5,$$
- for all $a, b \in G$. Show that G is abelian.
- (b) Show that any subgroup of an infinite cyclic group is also an infinite cyclic group.
- (c) Show that if G is a group of order 10 then it must have a subgroup of order 5.
- (2) (a) Define a quotient group with an example. show that a subgroup N is normal in G iff $xN = Nx$ for all $x \in G$.
- (b) State and prove Third fundamental theorem of group isomorphism.
- (c) Define an alternating group with an example. State and prove cayley's theorem.
- (3) (a) Define an integral domain with an example. Show that every finite integral domain is a field.
- (b) Define a simple ring with an example. Show that a commutative ring with 1 which is a simple ring, is a field.
- (c) Define ring homomorphism with an example. Show that the only isomorphism of C onto C which maps reals to reals is the identity I_C or the conjugation map, where C is the field of complex numbers.
- (4) (a) 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 .
- (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 .
- (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.
- (5) (a) Define embedding. State and prove the embedding theorem.
- (b) Define Euclidean domain with an example and show that in a PID every non-zero ideal is maximal.
- (c) Define unique factorization domain with an example. If R is a UFD then show that an element in R is prime iff it is irreducible.

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B. Tech. [MC]

END SEM EXAMINATION

MC- 302 OPERATIONS RESEARCH

Roll No. 059

Fifth Semester

December -2015

Max. Marks: 70

Time: 3 Hours

Note-

1. Attempt any *FIVE* questions.
2. All questions carry equal marks.
3. Assume suitable missing data, if any.

Q. 1 An industrial project has the following data:

Activity	Immediate Predecessor(s)	Duration (Weeks)
A	-	5
B	-	5
C	B	2
D	A,C	2
E	A,C	3
F	A,C	1
G	B	2
H	B	7
I	E	13
J	E,D	6
K	F,G,H	4
L	H	5
M	J,K,L	5

I and M are terminal activities of the project.

- a) Develop a network diagram and find the critical path.
- b) Compute the total and free floats for the activity.

Q.2 A furniture maker has 6 units of wood and 28h of free time, in which he will make decorative screens. Two models have sold well in the past, so he will restrict himself to those two. He estimates that model 1 requires 2 units of wood and 7h of time, while model 2 requires 1 unit of wood and 8h of time. The prices of the models are \$120 and \$80 respectively. How many screens of each model should the furniture maker assemble if he wishes to maximize his sales revenue? Also give a graphical solution of the problem.

Q. 3 Determine the optimum basic feasible solution of the following transportation problem

	To			Available
	A	B	C	
I	50	30	220	1
From II	90	45	170	3
III	250	200	50	4
Required	4	2	2	

Q.4 An automobile dealer wishes to put four repairmen to four different jobs. The repairmen have somewhat different kind of skills and they exhibit different levels of efficiency from one job to another. The dealer has estimated the number of man hours that would be required for each job – man combination. This is given in the matrix form in following table

Man \ Job	A	B	C	D
1	5	3	2	8
2	7	9	2	6
3	6	4	5	7
4	5	7	7	8

Find the optimum assignment that will result in minimum manhours needed.

Q.5 Use dual simplex to solve

$$\text{Min } z = 3x_1 + x_2$$

Subject to $x_1 + x_2 \geq 1$, $2x_1 + 3x_2 \geq 2$, x_1 and $x_2 \geq 0$ and verify the solution with the graphical solution.

Q.6 Solve the following LPP by Big M method

$$\text{Max } z = 8x_2$$

Subject to $x_1 - x_2 \geq 0$, $2x_1 + 3x_2 \leq -6$,

x_1 and x_2 are unrestricted.

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Roll No. 059

5th SEMESTER

B.Tech (MC- Engg.)

END SEMESTER EXAMINATION

Nov 2014

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 USD/Euro exchange rate is 1.4000 dollar per euro. The six month forward exchange rate is 1.3950. The six month USD interest rate is 1% per annum continuously compounded. Estimate the six month euro interest rate. 4

- (b) Let $A(0)=100$, $A(1)=110$, $A(2)=121$, and stock price can follow four possible scenario; 6

Scenari	$S(0)$	$S(1)$	$S(2)$
0			
W1	90	100	112
W2	90	100	106
W3	90	80	90
W4	90	80	80

$S(i)$, $i=0,1,2$ is stock price at i th time interval. Compute RNP.

- (c) Consider a portfolio of two assets a_1 & a_2 with no short sell, with the following statistical parameters $\mu_1=7.5\%$, $\mu_2=12\%$, $\sigma_1=11\%$, $\sigma_2=37\%$ $\rho_{12} = -0.17$. Find the value of minimum risk, the expected return and weight of the assets. 6

- (d) The stock price is Rs.100. The annual continuously compounded risk free interest rate is 5% and the annual volatility relevant for the Black Scholes formula is 20%. European Call options are written with a strike price of Rs.80 and time to expiration of 3 months. The stock will pay a dividend continuously at he rate of 2%. Use the Black - Scholes formula to find the price of one such call option. 6

- (e) Evaluate $\int_0^T W^2(t)dW(t)$ using Ito - Doeblin formula of version two. 6

2. (a) European call and put options with strike price Rs.24 and exercise date in six months are trading at Rs.5.10 and Rs.7.80. The price of the under lying stock is Rs.20.40 and the interest rate is 7.50 %. Decide whether an arbitrage opportunity exist? If yes, find it.
- (b) Discuss and Find the bounds for call option price and put options price of a underlying asset having price $S(0)$ and strike price X .
3. (a) $\{N(t), t \geq 0\}$ be a Poisson process with parameter λ . Prove that $\{N(t) - \lambda t, t \geq 0\}$ is a martingale.
- (b) A stochastic process $\{S(t), t \geq 0\}$ is governed by $dS(t) = aS(t)dt + bS(t)dW(t)$, where a & b are constants. Find the SDE of $\sqrt{S(t)}$.
4. (a) For European call and put options on a stock having the same expiry and strike price. Stock price is Rs.85, and the strike price is Rs.90, continuously compounding risk free interest rate is 4%, continuously compounding dividend rate on the stock is 2%. If the premium on call and put options are Rs.9.91 & Rs. 12.63 respectively, then determine the time to expiry for the option.
- (b) Obtain Cox-Ross-Rubinstein (CRR) model for the Stock price in future.
5. (a) A portfolio consisting of two assets a_1 & a_2 with weights w_1 & w_2 , return r_1 & r_2 , and S.D. σ_1 & σ_2 respectively. Also $\rho_{12} = 1$. Find the expression of weights & return for minimum risk of portfolio. Also find the value of minimum risk.
- (b) Using the following data:
- | Scenario | Probability | Return K1 | Return K2 |
|-------------------------|-------------|-----------|-----------|
| ω_1 (recession) | 0.2 | -10% | -30% |
| ω_2 (stagnation) | 0.5 | 0% | 20% |
| ω_3 (boom) | 0.3 | 20% | 10% |
- Find the weights in a portfolio with expected return $\mu_v = 26\%$ and compute the risk of this portfolio

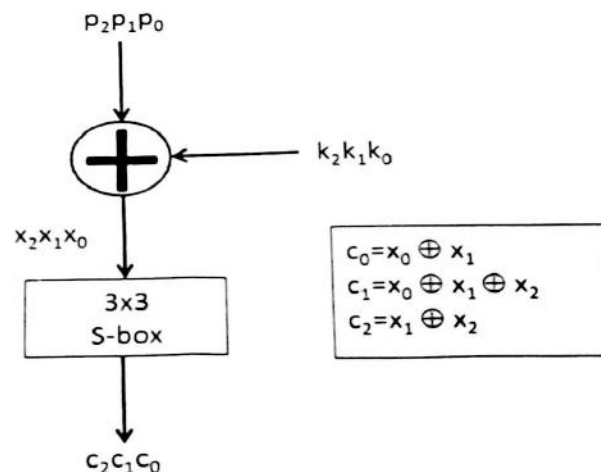
MC-304-Information and Network Security

Time: 3:00 Hours

Max. Marks: 70

Note: Answer any five questions.
Assume suitable missing data, if any.

1. (a) Design a mono alphabetic substitution cipher where key is a onetime pad which may be a dictionary word or sentence from some book. Explain process of designing substitution table from given key using suitable example. (5)
- (b) Compute following:
 - (i) $\phi(231)$
 - (ii) $\phi(440)$
 - (iii) $24140^{-1} \bmod 40902$
 - (iv) $550^{-1} \bmod 1769$
 - (v) $145^{102} \bmod 101$ (5x2=10)
2. (a) 20 persons of an organization want to communicate secretly with each other. Suggest three different methods of communication using symmetric /asymmetric keys. For each method, give total number of keys required for system.
- (b) Find the key $[k_2, k_1, k_0]$ for the following simple cipher (figure), assuming plaintext $[p_2, p_1, p_0]$ and cipher text $[c_2, c_1, c_0]$ are known.



(7+7=14)

3. (a) Implement RSA using $p=17$, $q=41$ and $e=11$. Find decryption key and all other parameters of algorithm. Show encryption of message "HELLO" using your setup.

(b) Explain the round key generation process for DES encryption algorithm. (7+7=14)

4. (a) Discuss the responsibilities of Data Link Layer in OSI model.

(b) List various network topologies and compare cost and reliability of all topologies. (7+7=14)

5. (a) What is a firewall and what are its limitations? What are different types of firewalls.

(b) Explain fast exponentiation (square and multiple) method with one example.

6. Explain following terms in Information security: (i) Confidentiality (ii) Authentication, (iii) DoS attacks (iv) Steganography (v) Non-repudiation (vi) Passive attacks v/s Active attacks (vii) Feistel and non-Feistel ciphers. (7x2=14)

7. (a) What is Kerberos. Explain complete message exchange sequence of Kerberos.

(b) What is digital signature. Explain generation and verification of any digital signature scheme. (7+7=20)

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B.TECH (MCE)

END SEM. EXAMINATION

MCE 305 DATABASE MANAGEMENT SYSTEM

Time: 3 Hours

Roll No. 059.....

FIFTH SEMESTER

(NOV./DEC-2015)

Maximum Marks : 70

Note: Attempt any 5 Questions. Question No. ONE is compulsory

Q1 Attempt the following:

- a. File processing system vs. DBMS
- b. Explain how the GROUP by clause works. What is the difference between the WHERE and HAVING clauses? Explain them with the help of an example (of SQL query) each.
- c. What is degree of relationship. Draw an ER diagram of unary relationship.
- d. Explain anomalies and its classification.
- e. What is the role of DBA.
- f. Types of Integrity constraints
- g. What is tuple relational calculus and domain relational calculus? (7X2=14)

Q2 Consider the following set of requirements for a university database that is used to keep track of student's transcripts:

- a) The University keeps track of each student's name, student number, current address and phone, permanent address and phone, DOB, sex, class (first year, second year etc), major department, minor department (if any) and degree program (B.A., B.S., Ph. D). Some user applications need to refer to the city, state, and zip code of the student's permanent address and to the student's last name. Both personal number and student number have unique values for every student.

- b) Each department is described by a name, department code, office number, office phone and college. Both name and code have unique values for each department.
- c) Each course has a course name, description, course number, number of semester hours, level and offering department. The value of the course number is unique for each course.
- d) Each section has an instructor, semester, year, course, and section number. The section number distinguishes sections of the same course that are taught during the same semester/year; its values are 1,2,3,....., up to the number of sections taught during each semester.
- e) A grade report has a student, section, letter grade, and numeric grade (0, 1, 2, 3 or 4).

Design and ER schema for this application, and draw an ER diagram for that schema. Specify key attributes of each entity type, and structural constraints on each relationship type. Note any unspecified requirements, and make appropriate assumptions to make the specification complete. (14)

Q3 Write the SQL Queries for the given schema:

Student (Name, Studentnumber, Class, Major)

Course (CourseName, CourseNumber, Credit Hours, Department)

Section (Sectionidentifier, coursenummer, Semester, Year, Instructor)

Grade_report (studentNumber, SectionIdentifier, Grade)

Prerequisite (Coursenummer, Prerequisite Number)

~~(a)~~ Change the class of student 'Uday' to 2.

~~(b)~~ Delete the record for the student whose name is 'GEETA' and whose studentnumber is 17.

(c) For each section taught by Prof. Jain., retrieve the course number, semester, year and number of students who took the section.

(d) Retrieve the names of all senior students majoring in 'CS'.

(e) Retrieve the names and major departments of all straight-A students (students who have a grade of A in all their courses).

2
2
3
2
3

(f) Insert a new course <'neural networks', 'CS4390', 3, 'CS'>. ²
(7X2=14)

Q4 (a) Explain the term 'functional dependency' with an example.
What are the Armstrong Inference Rules (IR)? State them.
(b) What is normalisation. Write its significance. Explain 2NF with example.
(2X7=14)

Q5 (a) What are different types of database languages. Classify them with example.
(b) What is data independence? Explain its types with diagram.
(2X7=14)

Q6 Write short notes (Any two):
(2X7=14)

1. Classification of Attributes
2. 3NF Vs BCNF
3. ACID Properties
4. DBMS