

Time: 3 Hours

Max. Marks: 70

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

- (1) (a) Show that if G is a semi group and for all a and b in G , the equations $ax = b$ and $ya = b$ have unique solutions in G iff G is a group.
(b) Show that if G is a finite cyclic group of order n , then G has a unique subgroup of order d for every divisor d of n .
(c) Show that if G is a group of order 10 then it must have a subgroup of order 5.
- (2) (a) Define group isomorphism with an example. Show that any infinite cyclic group is isomorphic to \mathbb{Z} and any finite cyclic group of order n is isomorphic to \mathbb{Z}_n .
(b) State and prove Second fundamental theorem of group isomorphism.
(c) Define an alternating group with an example. State and prove Cayley's theorem.
- (3) (a) Define skew field and show that a quaternion ring is a skew field.
(b) Define a simple ring with an example. Show that every field is simple field but not conversely.
(c) In a ring R , with unity, $(xy)^2 = x^2y^2$ for all $x, y \in R$, then show that R is commutative.
- (4) (a) State and prove fundamental theorem of ring homomorphism.
(b) Define prime ideal with an example and show that an ideal P in a commutative ring R is a prime ideal iff R/P is an integral domain.
(c) Show that An ideal M in \mathbb{Z} is maximal ideal iff $M = p\mathbb{Z}$ where p is a prime. Also give an example of a prime ideal which is not maximal.
- (5) (a) Define principal ideal domain with an example and show that every Euclidean domain is PID but not conversely.
(b) Define unique factorization domain with an example. Show that both Euclidean domain and PID are UFD.
(c) State and prove the embedding theorem.
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Roll No.59

FIFTH SEMESTER

B.Tech. (MC)

END SEMESTER EXAMINATION

(Nov -2016)

MC 302 OPERATIONS RESEARCH

Time: 3 Hour

Max. Marks: 70

Note: Answer all questions and each question is of equal marks

Assume suitable missing data, if any.

Q 1 A Gear manufacturing company has negotiated a contract to supply alloyed metal gears in a monthly basis. The company employs both skilled worker and apprentices. The average output of a skilled worker is three gears per hour, apprentices average two gears per hour including benefits to each skilled worker costs \$3840.00 per month and each apprentice costs \$2400.00 per month.

If The manufacturing company management policy is to appoint at least 25 skilled workers and atleast 15 more skilled workers than apprentices will be employed within the maximum budget for labour costs is \$200,000.00 How many skilled workers and apprentices should be assigned to the manufacturing unit to maximize the monthly production of Gears? Assume each worker works 160 hours per month and both skilled workers and apprentice can be assigned part times so that fractional value are permitted.

Q 2 Solve the following LP problem using the dual simplex method

$$\text{Min } 3x_1 + 4x_2 + 5x_3$$

$$\text{Subject to } 2x_1 + 2x_2 + x_3 \geq 6;$$

$$x_1 + 2x_2 + 3x_3 \geq 5, x_1, x_2, x_3 \geq 0$$

Q 3 An investment Bank has a total budget of 14 million dollars and can make 4 types of investments (numbered 1, 2, 3, 4). The following table specifies the amount to be invested and the net revenue for each investment. Each investment must be made in full if made at all.

Investment	Investor-1	Investor-2	Investor-3	Investor-4
Amount in Millions \$	5	7	4	3
Net revenue in millions \$	16	22	12	8

Formulate an integer linear program to maximize the total net revenue. Suggest an algorithm besides the simplex algorithm, to solve the continuous relaxation of the problem, and use it within a branch and bound algorithm to solve the problem.

Q4. Solve the following Problem using Gomory's cutting plane method:

$$\text{Minimize } x_1 - 2x_2$$

$$\text{Subject to } -4x_1 + 6x_2 \leq 9; \quad \text{and } x_1 + x_2 \leq 4, x_1, x_2 \geq 0 \text{ and integers.}$$

Q5 Indian Oil transporter agency carry some empty containers from 6 stores S1, S2, S3, S4, S5, S6 having empty containers 10, 12, 20, 24, 18, and 40 respectively. The demand of empty containers at ports P1, P2, P3, P4, and P5 are 20, 15, 25, 33 and 21 respectively. The transportation is carried out by a fleet of lorries. The transportation cost for each container is proportional to the distance travelled by the lorry, and amounts to INR30.00 per Km. Every lorry can carry at most two containers. Distances are as follows

	Port-P1	Port-P2	Port P3	Port-P4	Port P5
Store S1	240 km	115 km	355 km	785 km	810 km
Store S2	380 km	340 km	165 km	300 km	610 km
Store S3	505 km	530 km	285 km	220 km	450 km
Store S4	655 km	450 km	155 km	240 km	325 km
Store S5	1010 km	840 km	550 km	305 km	95 km
Store S6	1072 km	1097 km	747 km	372 km	333 km

Writ a mathematical program to find the minimal cost transportation policy to solve it with the software TORA or MATLAB (do not write codes).

Q6 Seven tasks must be performed through 3 CPUSs whose Pulse frequencies 1.33, 2, and 2.66 GHz. Each Processor can process one task at a time. The number of elementary operators of the tasks are expressed in billion instructions (BI). The processor assigned quantity of instructions are mentioned in the following table

	Process-1	Process 2	Process-3	Process-4	Process-5	Process-6	Process-7
Instructions in BI	1.1	2.1	3	1	0.7	5	3

Write a task assignment schedule to process the billion instructions so that the completion time of the last task is minimized. This is the CPU schedule assignment tasks a kind of assignment problem and different to the assignment problem solution method you learned may not be fitted.

Cont...

Q7. Some of the activities of a computer manufacturer is mentioned in the following table with the completion Hours

Activity	Manufacturing Items	Immediate predecessor Activity	Hours
A	USB Port plug	--	2
B	Cable	--	10
C	Flip Circuit Card	--	3
D	Micro controller	--	10
E	Chips	--	5
F	Hard disc drive system	--	10
H	Laser scanner	F	3
I	Main Board Integrated circuits	A, C, D, E	15
J	CPU Assembly	I, E,	3
K	Key board	--	5
L	Soldering	I, P	5
M	Mouse parts	--	5
N	Computer cabinet	--	10
O	Disc Operating system	S	10
P	Printed Circuit card	--	5
Q	Monitor cabinet	--	10
R	Monitor	Q	10
S	Assembling	I, L, N	5

Represent the listed activities in a graph with Vertices and edges. Determine the earliest starting, earliest finish, latest start, and latest finish time of the activities using the assumption: LF = minimum of LS of the immediate successor activities, LS = LF - Activity completion time; ES = maximum EF of all immediate predecessors, EF = ES + Activity completion time. Determine the Critical Path.

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Roll No. 59

5th SEMESTER

B.Tech (MC- Engg.)

END SEMESTER EXAMINATION

Nov 2016

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 stock price is Rs.90. The annual continuously compounded risk free interest rate is 6% and the annual volatility relevant for the Black Scholes formula is 25%. Call options are written with a strike price of Rs.75 and time to expiration of 3 years. The stock will pay a dividend of Rs.25 In 2 years . Use the Black – Scholes formula to find the price of one such call option. 4
- (b) A non-dividend paying stock is currently selling at Rs. 80 with annual volatility 22%. Assume that the continuously compounded risk-free interest rate is 5%. Using a two period CRR binomial option pricing model, find the price of one European *call option* on this stock with a strike price of Rs. 80 and time to expiration 3 years. 6
- (c) Consider a portfolio of two assets a_1 & a_2 with no short sell, with the following statistical parameters $\mu_1=8\%$, $\mu_2=12\%$, $\sigma_1=10\%$, $\sigma_2=30\%$, $\rho_{12} = -0.05$. Find the value of minimum risk, the expected return and weight of the assets. 6
- (d) The stock price $S(t)$ follows the lognormal distribution and satisfy the SDE $dS(t) = \mu S(t)dt + \sigma S(t)dW(t)$, at $t = 0$ the price of the stock is $S(0)$. The current price of the stock is \$50 with expected return on the stock 18 % per annum and volatility 30 % per annum. Find the distribution of the stock price. 6
- (e) Evaluate $\int_0^T W(t) dW(t)$ using quadratic variation . 6

2. (a) If S_1 & S_2 are two current price of a stock such that $S_1 < S_2$, then prove that $C^E(S_1) < C^E(S_2)$. 7
- (b) Let $S(0) = \$50, r = 10\% \text{ per annum}, u = 0.3 \text{ and } d = -0.1$. Find the price of a European call option with strike time 1.5 year with strike price $X = 60$ dollars to be exercised after $N = 3$ time steps using CRR-formula. 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) Find the solution of SDE $dX(t) = X(t)dW(t)$, given that $X(0) = 1$, using Ito-Doeblin formula version two. 7
4. (a) Define Wiener Process and show that it is not wide sense stationary 7
- (b) Prove that the value of a forward contract ($f(\tau)$) at $t = \tau, 0 \leq \tau \leq T$, is given by $f(\tau) = [F(\tau, T) - F(0, T)]d(\tau, T)$, where $d(\tau, T)$ is discount factor from $t = \tau$ to $t = T$. 7
5. (a) For two assets portfolio with return μ_1 & μ_2 and risk σ_1 & σ_2 which have perfect positive correlation, find the value of weights for minimum risk of the portfolio. What will be the value of the risk? 7
- (b) Using the following data:

Scenario	Probability	Return K1	Return K2
ω_1 (recession)	0.4	-12 %	21 %
ω_2 (stagnation)	0.2	10 %	18 %
ω_3 (boom)	0.4	22 %	10 %

 Find the weights in a portfolio with expected return $\mu_v = 20\%$ and compute the risk of this portfolio 7

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5th SEMESTER

END SEMESTER EXAMINATION

Roll No 59

B.Tech.

(Nov- 2016)

MC-304 Information and network Security

Max. Marks: 70

Time: 3 Hours

Note: Note: Attempt any five question

Assume suitable missing data, if any.

Q1 (a) What are the type of malware (malicious software)? Briefly explain each of them. 5

(b) I. Find the solution of sets of congruence using Chinese remainder theorem: 5

$$X \equiv 2 \pmod{18}, X \equiv 3 \pmod{5} \text{ and } X \equiv 2 \pmod{7}$$

II. Find the solution of linear equation

$$14x \equiv 12 \pmod{18}$$

(c) What is a Digital certificate? What is the process of obtaining a digital certificate? 4

Q2 (a) Describe the steps involved in providing authentication and confidentiality by PGP 5

(b) Define Kerberos and name its server. Briefly explain the duties of each server. 5

(c) List the sequence of events that are required for a secure electronic transaction? 4

Q3 (a) With help of a block diagram explain DES encryption algorithm and also explain Triple DES with two keys. 5

(b) User A and B use the Diffie- Hellman key exchange technique with a common prime $q=71$ and a primitive root $\alpha=7$.

a. If user A has private key $X_A=5$, what is A's public key Y_A ?

b. If user B has private key $X_B=12$, what is B's public key Y_B ?

What is the shared secret key?

(C) Describe confusion and diffusion. 4

Q4 (a) Discuss the following with respect to SSL Architecture:

I. SSL session

II. SSL Connection

(b) Explain WAP architecture and how the security is achieved. 5

(c) Explain S Box and P box. 4

- Q5 (a) Give a brief overview of each of the transport mode and tunnel mode and also discuss application and benefits of IP security? 5
- (b) What are the principles of the public key cryptosystem? Differentiate conventional encryption and public key encryption 5
- (c) Use a Vigenere cipher to encipher the message “we live in a world” use the following key: “PASCAL”. 4
- Q6. (a). Explain the Secure hash algorithm in detail and why is SHA1 more secure than MD5? 5
- (b) Perform encryption and decryption using RSA for the following.
 $P=7, q=11, e=17, M=6.$
(P and q are prime numbers, e –encryption key, M- message) 5
- (c) What is the function of Network Layer in OSI model? 4
- Q7 write short notes (any Four) 14
- I. Master key and Session key
 - II. MIME
 - III. MDC
 - IV. Steganography
 - V. Passive attacks
 - VI. Electronic money

MC-305 DATABASE MANAGEMENT SYSTEM

Time: 3:00 Hours

Max. Marks : 70

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

- Q 1. (a) Who is DBA and his role? 4
(b) Differentiate between DBMS and RDBMS. Name a few RDBMS Software and their features. 5
(c) Explain different types of Indexing. 6
- Q 2. (a) An organization purchases items from a number of suppliers. Suppliers are identified by SUP-ID. It keeps track of the number of each item type purchased from each supplier. It also keeps a record of supplier's addresses. Supplied items are identified by ITEM-TYPE and have description (DESC). There may be more than one such addresses for each supplier and the price charged by each supplier for each item type is stored. There are customers, who purchases these items. Track of the items purchased are also kept. Identify the entities and relationships for this organization and construct an E-R diagram. From the E-R diagram. 7
(b) What are different data models? Explain in detail. 7
- Q 3. (a) Define the following with examples: 6
(i) Referential Integrity (ii) Instance (iii) Database schema.
(b) Define trigger and assertion. How they are created give examples. 8
- Q 4. (a) What is normalization and why do we need normalization? 7
(b) Consider the universal relation $R = \{ A, B, C, D, E, F, G, H, I \}$ and set of functional dependencies $F = (\{A, B\} \rightarrow \{C\}, \{B, D\} \rightarrow \{E, F\}, \{A, D\} \rightarrow \{G, H\}, \{A\} \rightarrow \{I\})$. What is the key of R ? Decompose R into 3NF relations. 7
- Q 5. (a) Explain time-stamp based timestamp based concurrency control protocol. Is this protocol ensures freedom from deadlock? 5

(b) What is starvation? 3
(c) What are the various conditions under which deadlock occurs?
Discuss different prevention techniques. 6

Q6. (a) Compare conflict and view serializability. 4
(b) Consider the following Insurance database 10

person (driver-id, name, address)
car (license, model, year)
accident (report-number, date, location)
owns (driver-id, license)
participated (driver-id, car, report-number, damage-amount)

Give an expression in SQL for each of the following queries.

- i. Find the names of all employees who work for First Bank Corporation.
- ii. Find the names and cities of residence of all employees who work for First Bank Corporation.
- iii. Find the names, street addresses, and cities of residence of all employees who work for Second Bank Org and earn less than 1 lac rupees.
- iv. Find all employees in the database who live in the same cities as the companies for which they work.

Q7. Write short notes (any two) 14

- (a) Data Recovery
- (b) File organization
- (c) Relation algebra