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Roll No: MC/53

6th Semester

B.Tech. [MC]

End Term Examination

May 2019

MC 302 Database Management System

Time: 3 hours

Max Marks: 40

NOTE: *Attempt any five (5) Questions. Q1 IS COMPULSORY. Assume suitable missing data, if any.*

Q1 Answer the following questions. [2 * 6 = 12]

a) Under what conditions can an attribute of a binary relationship type be migrated to become an attribute of one of the participating entity types?

b) Consider the following relations P(ABC), Q(ABD), R(AE)

P(ABC)

A1	B1	C1
A2	B1	C2
A3	B3	C2

Q(ABD)

A1	B1	2
A1	B2	5
A2	B1	6
A3	B3	1

R(AE)

A1	E1
A3	E2
A4	E3
A4	NULL

What is the output of the following SQL query on the above relations?

SELECT * FROM Q FULL OUTER JOIN R ON Q.A = R.A;

c) If a relation instance is violating an FD (functional dependency), then the relation can be made to satisfy the FD by possibly adding some selected tuples. State True or False. Justify.

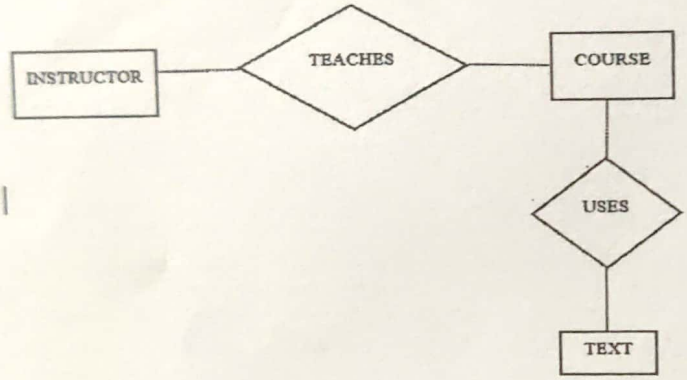
d) If a relation instance is violating an MD (multivalued dependency), then the relation can be made to satisfy the MD by possibly adding some selected tuples. State True or False. Justify.

e) What is the difference between primary index and clustering index?

f) Discuss the typical phases of an optimistic concurrency control method.

Q2. a) What is meant by recursive relationship type? Give two examples of recursive relationship types. [3 marks]

b) Consider the ER diagram in Figure. Assume that a course may or may not use a textbook, but that a text by definition is a book that is used in some course. A course may not use more than five books. Instructors teach from two to four courses. Supply (min, max) constraints on this diagram. *State clearly any additional assumptions you make.* If we add the relationship ADOPTS between INSTRUCTOR and TEXT, what (min, max) constraints would you put on it? Why? [4 marks]



Q3 Given the following relations from a literary database:

Authors (author_id, first_name, last_name, country, birth_year)

Books(title, author_id, publication_year)

Nobel_Winners(author_id, award_year)

Write ***relational algebra expressions*** and ***SQL queries*** that compute the following queries:

a) List titles of books by Nobel Prize winners that were published after 1940. [3 marks]

b) List pair of author_id from the same country such that one of them received the Nobel prize and the other did not. [4 marks]

Q4. a) When are two sets of functional dependencies equivalent? How can we determine their equivalence? [3 marks]

b)Consider the following relation: CAR_SALE(Car#, Date_sold, Salesperson#, Commission%, Discount_amt). Assume that a car may be sold by multiple salespeople, and hence {Car#, Salesperson#} is the primary key. Additional dependencies are Date_sold → Discount_amt and Salesperson# → Commission%. Based on the given primary key, is this relation in 1NF, 2NF, or 3NF? Why or why not? How would you successively normalize it completely? [4 marks]

Q5. a) Discuss the various options for creating a secondary index on a non-key, non-ordering field of a file. [3 marks]

b) Consider a disk with block size B = 512 bytes. A block pointer is P=6 bytes long and a record pointer is P_R =7 bytes long. A file has r=30,000 EMPLOYEE records of fixed-length. Each record has the following fields: NAME (30 bytes), SSN (9bytes), DEPARTMENTCODE (9 bytes), ADDRESS (40 bytes), PHONE (9 bytes), BIRTHDATE (8 bytes), SEX (1 byte), JOBCODE (4 bytes), SALARY (4 bytes, real number). An additional byte is used as a deletion marker. [4 marks]

Suppose the file is not ordered by the non-key field DEPARTMENTCODE and we want to construct a secondary index on DEPARTMENTCODE, with an extra level of indirection that stores record pointers. Assume there are 1000 distinct values of DEPARTMENTCODE, and that the EMPLOYEE records are evenly distributed among these values. Calculate

1) the index blocking factor bfr_i (which is also the index fan-out fo)
2) the number of blocks needed by the level of indirection that stores record pointers

3) the number of first-level index entries and the number of first-level index blocks

4) the number of levels needed if we make it a multi-level index.

5) The approximate number of block accesses needed to search for and retrieve all records in the file that have a specific department_code value, using the index.

Q6.a) Describe two schemes for deadlock prevention in a concurrency control system of a database. [3 marks]

b) Consider the following two schedules S1 and S2. The actions are listed in the order they are scheduled and subscripted with the transaction name.

$S1 = W_1(X), R_2(X), W_1(X), Abort_2, Commit_1$

$S2 = R_2(X), W_3(X), Commit_3, W_1(Y), Commit_1, R_2(Y), W_2(Z), Commit_2$

For each of the above schedules, draw the precedence graph and decide which of the following two classes the schedules belong to: conflict-serializable, and view-serializable. Explain. [4 marks]

Q7 a) List ACID Properties of transaction. Explain the usefulness of each. [3 marks]

b) Construct a B+ tree for the following set of key values: {2, 3, 5, 7, 11, 17, 19, 23, 29, 31}. Assume that the tree is initially empty and the values are added in ascending order. Consider that four pointers will fit in one node of the tree.

Show the form of the tree after the following sequence of following operations: i. Insert 9, ii. Insert 10, iii. Delete 23, iv. Delete 19. [4 marks]

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Roll No. MC453

SIXTH SEMESTER

B.Tech

END SEMESTER EXAMINATION ***May/June-2019***

MC 304 THEORY OF COMPUTATION

Time: 3:00 Hours ***Max. Marks: 50***

Note : Question no. 1 is compulsory. Answer any four questions from the remaining questions. Assume suitable missing data, if any.

Q.1 Choose the correct answer. Justify (10)

i. $(a + a^*)^*$ is equivalent to
   a) $a(a^*)^*$
   b) a^*
   c) aa^*
   d) *none of these*

ii. In a deterministic pda, $|\delta(q, a, Z)|$ is
   a) Equal to 1
   b) Less than or equal to 1
   c) Greater than 1
   d) Greater than or equal to 1

iii. In a standard TM $(Q, \Sigma, \Gamma, \delta, q_0, b, F)$ the blank symbol b is in
   a) $\Sigma - \Gamma$
   b) $\Gamma - \Sigma$
   c) $\Gamma \cup \Sigma$
   d) None of these

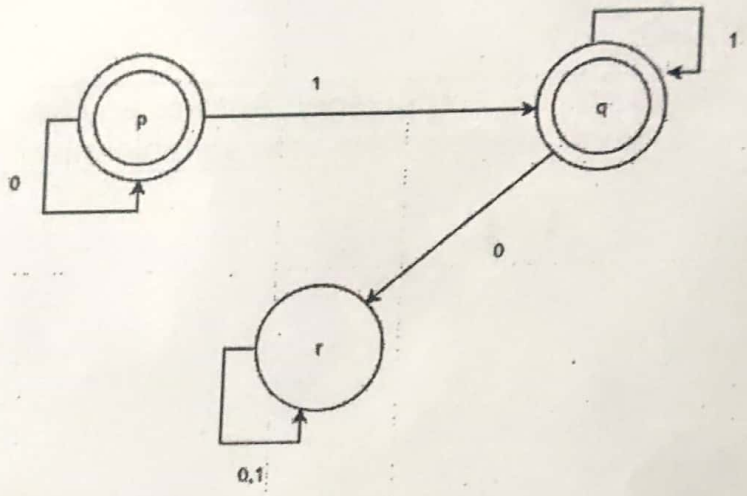
iv. $\{a^n b^n | n \geq 1\}$ is accepted by a pda
   a) By null store and but not by final state.
   b) By final state but not by null store.
   c) By null store and also by final state.
   d) Neither by final state nor by null store

Q.1 State True or False with justification.

a) If L_1 and L_2 are subsets of $\{a, b\}^*$ such that $L_1 \subseteq L_2$ and L_1 is not regular language, then L_2 is not regular language.

b) Any derivation tree for a regular grammar is a binary tree.

Q.2 [a] Show that if L is regular then L^T is also regular. Consider the FA M given below. What is $(T(M))^T$? (5)



[b]Construct a Turing Machine that can accept the strings over {0,1} containing even number of 1's. Also, construct a computation sequence of 10101. (5)

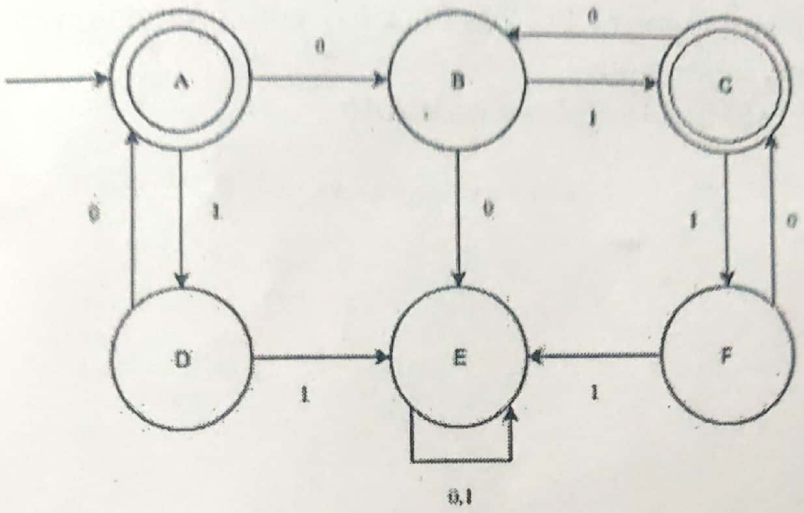
Q.3[a] Define Chomsky Classification of languages. Construct a regular grammar to generate {abc, bca, cab} with $\Sigma = \{a, b, c\}$. (5)

[b] Reduce the grammar to CNF :

$S \rightarrow aSa|bSb|A|\wedge \quad A \rightarrow a|b|\wedge$ (5)

Q.4[a] State and prove Pumping Lemma for regular sets. Is $\{a^p \mid p \text{ is prime}\}$ regular. (5)

[b] Minimize the automata : (5)



Q.5 [a] Construct a Moore machine equivalent to the Mealy machine below: (5)

Present State	Next State			
	a= 0		a= 1	
	State	Output	State	Output
$\rightarrow q_1$	q_1	1	q_2	0
q_2	q_4	1	q_4	1
q_3	q_2	1	q_3	1
q_4	q_3	0	q_1	1

[b] Prove that if $A = (Q, \Sigma, \Gamma, \delta, q_0, Z_0, F)$ is a pda accepting a CFL L by empty store, we can find a pda B which accepts L by final state i.e. $L = N(A) = T(B)$. (5)

Q.6[a] $A = (Q, \Sigma, \Gamma, \delta, q_0, Z_0, F)$ where $Q = \{q_0, q_1, q_f\}$, $\Sigma = \{a, b\}$, $\Gamma = \{a, Z_0\}$, $F = \{q_f\}$ and δ is given by:

$\delta(q_0, a, Z_0) = \{(q_0, aZ_0)\}$,
$\delta(q_0, a, a) = \{(q_0, aa)\}$,
$\delta(q_0, b, a) = \{(q_1, \Lambda)\}$
$\delta(q_1, b, a) = \{(q_1, \Lambda)\}$
$\delta(q_1, \Lambda, Z_0) = \{(q_1, \Lambda)\}$

Construct a CFG G such that $L(G) = N(A)$. (5)

[b] What is an ambiguous CFG ? Is the CFG with production rules as given below ambiguous?

$S \rightarrow a|abSb|aAb \ , A \rightarrow bS|aAAb$ (5)

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2K16/MC/53

Total no. of pages :2 Roll No. MC/53

6th SEMESTER B.Tech (MC- Engg.)

END SEMESTER EXAMINATION May 2019

MC – 306 Financial Engineering

Time : 3 hrs Max. Marks: 50

Note: *Q.No.1 is compulsory, answer any other three questions.* All questions carry equal mark. Statistical table is allowed. Assume missing data , if any.

1. (a) Define forward contract. Let $B(0) = Rs.100$, $B(1) = Rs.112$, $S(0) = RS.34$ *and* $T = 1$. Find the forward price F. Also find an arbitrage opportunity if F is taken to be Rs.38.60.

(b) The current stock price is Rs. 250. A six month call option on this stock with strike price Rs. 255 is priced using Black-Scholes formula. It is given that continuously compounded risk free rate is 4%, stock pays no dividend and the volatility of the stock is 20%. Determine the price of call and put options.

(c) Let $\{N(t), t \geq 0\}$ be a Poisson process with parameter λ. Prove that $\{N(t) - \lambda t;\ \lambda > 0\}$ is a martingale.

(d) A portfolio consisting of two assets a_1 and a_2 with weights w_1 and w_2, returns r_1 and r_2 and standard deviations σ_1 and σ_2 respectively. Also $\rho_{12} = 1$. Find the expression of weights and return for minimum risk of portfolio. Also find the value of minimum risk.

2. (a) Evaluate $\int_0^T w(t)dw(t)$ using quadratic variation.

(b) Consider a stock whose value S(t) follows sde $dS = r.Sdt + \sigma.SdW$ and has a current price Rs.40. What is the probability that a call option is exercised based on a strike price $K = Rs.52$ at time of expiration T? Given that $T = 0.5, r = 0.04$ and $\sigma = 0.20$.

3. (a) Let S(0) = \$50, r = 5%, u = 0.13 and d = −0.08. Find the price of a European call and put with strike price X = \$55 to be exercised after N = 3 time steps using CRR- formula.

(b) Find the SDE of $W^3(t)$ using Ito-Doeblin formula of version two.

4. (a) Define risk neutral probability, obtain its expression. Prove that under risk neutral probability after nth period
$E\{S(n)\} = S(0)[1+r]^n$, where 'r' is risk free interest rate.

(b) Derive the expression for line which converts into Capital Market line.

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

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

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

(b) Consider a portfolio of the assets a_1 and a_2 with no short sell and with the following statistical parameters $\mu_1 = 15\%$, $\mu_2 = 30\%$, $\sigma_1 = 20\%$, $\sigma_2 = 35\%$, $Cov(r_1, r_2) = -0.0035$, where r_1 & r_2 are return of the assets. Find the value of weights for minimum risk, expected return and minimum risk of the portfolio.

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Roll No: 2K16/MC/153

SIXTH SEMESTER

B.Tech.[Elective]

END SEMESTER EXAMINATION

May, 2019

MC324, Big Data Analytics

Time: 3.0 Hours

M.M.: 50

Note: *Attempt ALL questions. Assume suitable missing data, if any. Write your answer concisely. All questions carry equal marks.*

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1. Define Big Data and its characteristics.

2. Discuss analytic processes and tools.

3. Discuss Estimating moments with an example

4. Height of fathers and sons in inches are given below:

Height of Father:-	65	66	67	67	68	69	70
Height of Son:-	66	68	65	69	74	73	72

Find two lines of regression and calculate the estimated average height of son when the height of father is 68.5 inches.

5. For a given set of values, fit the quadratics polynomial and approximate $f'(2.2)$.

x	2.00	2.2	2.6
$f(x)$	0.69315	0.78846	0.95551

6. A machine produces a large number of items of which 15% are found to be defective. If a random sample of 200 items is taken from the population and sample proportion is calculated then find

(i) Mean and standard error of sampling distribution of proportion.

(ii) The probability that less than or equal to 12% defectives are found in the sample. [5+5]

7. If $X_1, X_2, \ldots X_m$ is a random sample taken from binomial distribution (n, p) where, n and p are unknown, obtain moment estimators for both n and p. [5+5]

8. Write a short note on NDFS and its uses.

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