

Total No. of Pages: 2

Roll No.

FOURTH SEMESTER

B.Tech. (FT)

MID SEMESTER EXAMINATION March-2018

SE-202 SOFTWARE ENGINEERING

Time: 3:00 Hours

Max. Marks: 30

Note: All questions are compulsory.

Assume suitable missing data, if any.

1 [a] Differentiate between program and software? (3)

[b] List out requirement elicitation techniques. Which one is most popular and why? (4)

[c] What is the purpose of CASE? (2)

[d] What is coupling? Explain best and worst type of coupling. (4)

[e] Why is the sum of μ_p and τ_p in COCOMO model not equal to 1? (2)

2 What is the purpose of prototyping model? List advantages of this model.

(3)

3 [a] A university is organized in different teaching schools and each school conducts a variety of programmes. Students are registered in various schools manually based on the admission slips. Students are assigned courses depending upon the scheme of the selected programme. Every school is responsible for its registration process and following are prepared and maintained manually:

- List of students registered in a programme.
- List of students registered for a particular course.
- List of courses offered in a particular semester.
- List of faculty in a school.
- Personal details of the students.
- Registration card for every registered student.

University decides to automate the manual registration process in order to improve the existing system. The proposed system, University Registration System (URS) should perform the following functions:

- Maintain the personal details of the students.
- Maintain the details of the faculty.

P.T.O.

programme.

- Issue of registration card to the student in every semester.
- Generate list of programmes offered by university.
- Generate list of courses offered in a particular semester for a particular programme.

Draw the following using standard notations. If necessary, you can make suitable assumptions regarding the details of various features of URS, but you must clearly write down the assumptions you make.

1. Draw context level diagram. (2)
2. Draw level-1 DFD for the URS. (5)
3. Draw level-2 DFD for maintain students details process. (5)

END

Total No. of Page: 02

Roll No.....

**IV SEMESTER
MID SEMESTER EXAMINATION**

**B.TECH. [IT]
(March 2018)**

IT-202 Database Management Systems

Time: 1.5 Hours

Max. Marks :30

Note: Attempt all questions

Assume suitable missing data, if any.

Q1. Briefly answer the following:

- What is the role of a DBA?
- Explain the following: metadata , schema, instance, relation state
- Difference between relational algebra and relational calculus?
- Differentiate between weak and strong entity.
- What is functional dependency and why it is used?

[2X5=10]

Q2. Answer the following:

- What is the importance of Normalization in DBMS? Explain its types.
- Consider the following relation

CAR_SALE(car#, Date_sold, Salesperson#, commission, discount_amt)

Assume that car may be sold by multiple salespersons and hence {car#, Salesperson#} is the primary key. Additional dependencies are:

{Date_sold → discount_amt ,
Salesperson# → commission}

Based on the given primary key, is this relation in 1NF, 2NF or 3NF? Why or Why not?
How could you normalize it completely (till BCNF, if possible?)

[2.5X2=5]

Q3 Write the sql queries for the relation Books(title,author,book_id,year_publication) 1x5

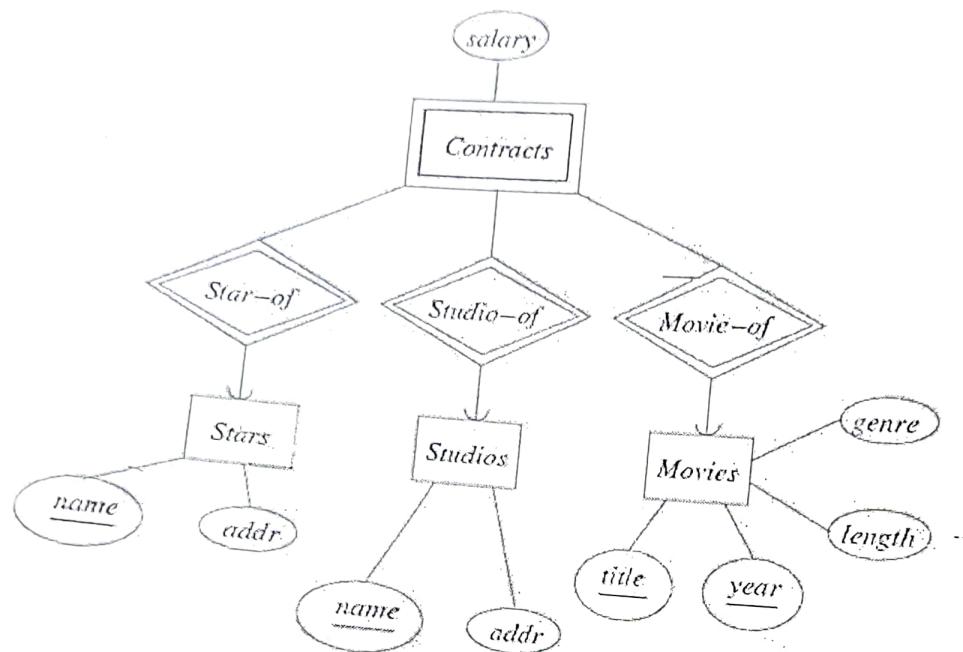
- Books(all details) whose author name has letter 'A' at the third place.
- Book (only title) with the second largest year of publication.
- Books (all details) published between 1990-2000 but not in year 1990 and 2000
- Create a table called mybooks including only year and title.
- Set the value of year to 2013 in mybooks (created above) where title starts with 'P'.

Q4 Explain the components of DBMS with the help of a diagram

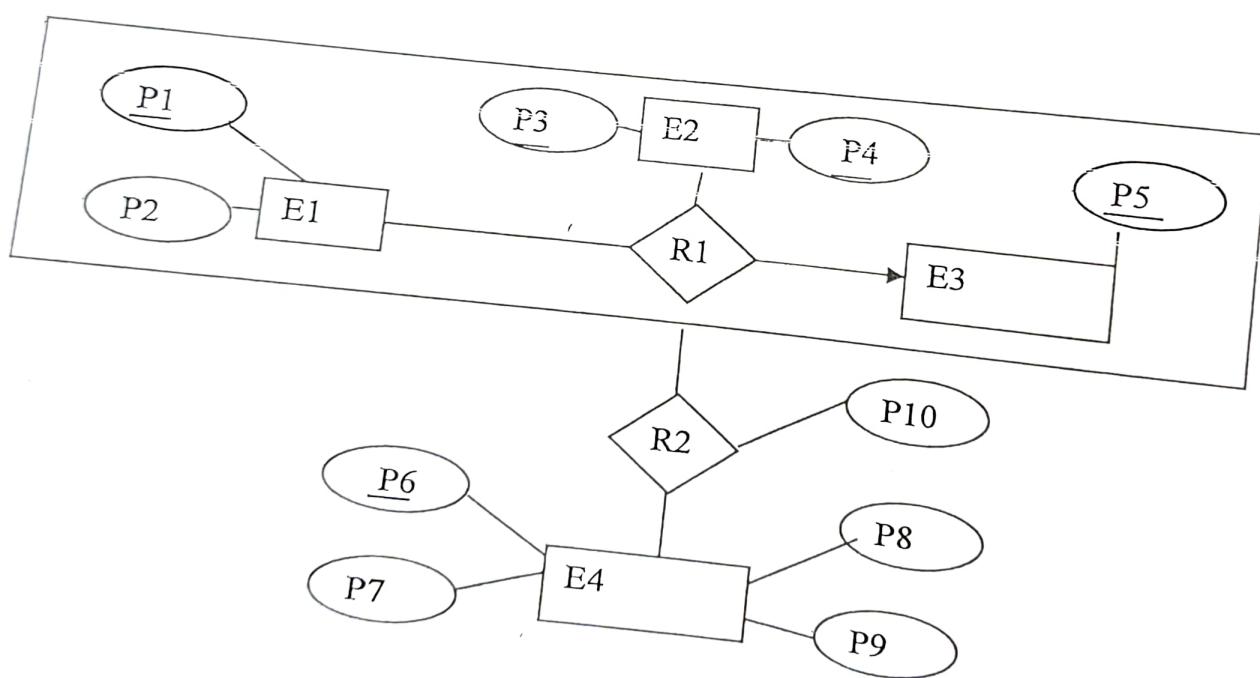
Q5 (a) Explain the concepts of extended ER diagram with the help of single example/diagram.

(b) Convert the following into rdbms:

1.



2.



[2.5X2=5]

-END-

CO 202 DATABASE MANAGEMENT SYSTEM

Time: 1.5 Hours

Maximum Marks : 30

Note: Attempt all questions. Assume suitable missing data, if any.

Q1 (a) Explain the concept of DBMS. Discuss its overall structure with diagram.

(b) What are different types of database interfaces. Classify them with example. (2X3=6)

Q2 Consider the following set of requirements for a Company database that is used to keep track of employee's department and their project transcripts:

Company is organized into various Department with a unique name and a particular employee who manages the department. Department may have several locations. Start date for the manager is recorded. A department controls a number of Projects with a unique name, number and a single location. Company's Employee name, id, address, salary, sex and birth date are recorded. An employee is assigned to one department, but may work for several projects (not necessarily controlled by his/her dept). Number of hours/week an employee works on each project is recorded; The immediate supervisor for the employee. Employee's Dependent are tracked for health insurance purposes (dependent name, birthdate, relationship to employee).

Draw an ER Diagram for the above problem statement. (6)

Q3 (i) Consider the following relational schema:

Author (AuthorId, FirstName, LastName)

AuthorPub (AuthorId, PubId, AuthorPosition)

Book (BookId, BookTitle, Month, Year, Editor)

Pub (PubId, Title, BookId)

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IV

AuthorId in AuthorPub is a foreign key referencing Author. PubId in AuthorPub is a foreign key referencing Pub. BookId in Pub is a foreign key referencing Book. Editor in Book is a foreign key referencing Author (AuthorId).

- (a) Determine the names of all authors who are book editors.
(b) Obtain the names of all authors who are not book editors.
(c) Get the names of all authors who have at least one publication in the database.

(3X1=3)

Write the above queries in Relational Algebra.

(ii) Consider the following relational schema:

Student (rollNo, name, degree, year, sex, deptNo, advisor)

Department (deptId, name, hod, phone)

Course (courseId, cname, credits, deptNo)

Enrollment (rollNo, courseId, sem, year, grade)

a. Determine the departments that do not have any girl students.

b. Obtain the names of courses enrolled by student named Thomas.

c. Get the names of students who have scored 'O' in all subjects they have enrolled. Assume that every student is enrolled in at least one course.

Write the above queries in Tuple Relational Calculus.

(3X1=3)

Q4 Explain Inference Rules in functional dependency. For a relation R{A,B,C,D,E,F,G} the given set of functional dependencies are as follows $A \rightarrow B$, $BC \rightarrow DE$, $AEF \rightarrow G$. Prove that $ACF \rightarrow DG$. (6)

Q5 (a) Explain the concept of database schema with diagram.

(b) Given are the two sets of FDs for the relation F and G:

$F = \{ B \rightarrow CD, AD \rightarrow E, B \rightarrow A \}$ and

$G = \{ B \rightarrow CDE, B \rightarrow ABC, AD \rightarrow E \}$.

Compute whether they are equivalent sets of FDs or not.

(2X3=6)

-END-

Total No. of Pages: 01

B. Tech. (AE/PE/ME/PS/EP/CE/MC)
Mid Semester Examination

HU-202: Engineering Economics

Time: 1 hr 30 min

Roll No.

Fourth Semester
(March-2018)

Max. Marks: 25

Note: All Questions are Compulsory.
Assume suitable missing data, if any.

1. Fill up the blanks: $10 * 1/2 = 5$
 - a. Wood is a ----- good in the forest but an ----- good near construction site.
 - b. Opportunity cost is the ----- of the next best option.
 - c. In Oligopoly, there are ----- number of firms.
 - d. The burden of tax falls on the same person who pays tax in case of ----- tax.
 - e. Subsidy ----- purchasing power in the hands of the people.
 - f. Cost of last unit produced is called ----- cost.
 - g. Value of money ----- in Inflation.
 - h. Labour gets ----- for its contribution in Production.
 - i. In case of Adverse Balance of Payment, value of Export is ----- than value of Import.
2. Differentiate between (10)
 - a. Monopoly and Monopolistic Competition Market?
 - b. Commercial bank and Central bank
3. Discuss concept of Business Cycle. (5)
4. What do you mean by Dumping in International Trade? (5)

-END-

Total No. of Pages: 03

Roll No.

B. Tech. [MC]

6th Semester

Mid Semester Examination

(March-2018)

MC-302 Database Management System

Time 1h 30 min.

Max. Marks: 30

NOTE: Attempt all Questions. Assume suitable missing data if any.

Q1. a) Number of rows in a relation are called its _____.

b) Every determinant should be a candidate key is the definition for which normal form?

c) The terms in list I have been mapped to list II so that it corresponds to the mapping process of the ER model into a relational model. Represent the mapping process between the lists?

LIST I

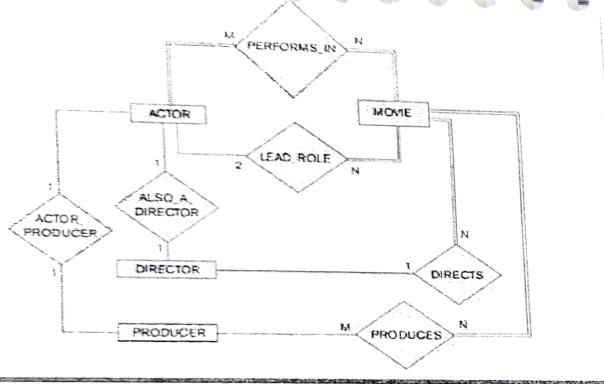
- a) Entity type
 - b) Composite attributes
 - c) Multivalued attributes
 - d) Value set ;
- i) Domain
 - ii) Relation and foreign key
 - iii) Set of simple component attributes
 - iv) Relation

LIST II

Q2 a) What are the advantages of DBMS over traditional file system (any three)?
[3 marks]

b) Explain different update anomalies with examples. [3 marks]

Q3. Consider the ER schema for the MOVIES database in figure. Assume that MOVIES is a populated database. ACTOR is used as a generic term and includes actresses. Given the constraints shown in the ER schema, respond to the following statements with True, False, or Maybe. Assign a response of Maybe to statements that, while not explicitly shown to be True, cannot be proven False based on the schema as shown. Briefly justify each answer. [6 marks]



- A) There are no actors in this database that have been in no movies.
 B) There are some actors who have acted in more than ten movies.
 C) A movie can have only a maximum of two lead actors.
 D) Every director has been an actor in some movie.
 E) There are movies with more than a dozen actors.
 F) Some producers have been a director as well.

Q4. a) Consider a database table T containing two columns X and Y each of type integer. After the creation of the table, one record ($X=1, Y=1$) is inserted in the table. Let MX and MY denote the respective maximum values of X and Y among all records in the table at any point in time. Using MX and MY, new records are inserted in the table 128 times with X and Y values being $MX+1, 2*MY+1$ respectively. It may be noted that each time after the insertion, values of MX and MY change. What will be the output of the following SQL query after the steps mentioned above are carried out?

SELECT Y FROM T WHERE X= 7; [2 marks]

b) Consider the given relations: Employee (FirstName, MidNameInitial, LastName, Ssn, DOB, Address, Sal, DepartmentNo) and Department (Dname, Dnumber, MgrSsn, MgrStartDate). [4 marks]

- Retrieve the birth date and address of the employee whose name is 'John B. Smith'.
- Retrieve the name and address of all the employees who work for the 'Research' department.

Q5. Consider the relation REFRIG(Model#, Year, Price, Manuf_plant, color). Which is abbreviated as REFRIG(M, Y, P, MP, C), and the following set F of functional dependencies: $F = \{M \rightarrow MP, \{M, Y\} \rightarrow P, MP \rightarrow C\}$

- Evaluate each of the following as candidate key for REFRIG, giving reasons why it cannot be a key: {M}, {M,Y}, {M,C}.
- Based on the above key determination, state whether the relation REFRIG is in 3NF and BCNF, and provide proper reasons.
- Consider the decomposition of REFRIG into $D = \{R_1(M, Y, P), R_2(M, MP, C)\}$. Is this decomposition lossless? Show why. [6 marks]

END

Q1. Answer to the point for any five from following:

- (i) Define the production system using water jug problem.
- (ii) Analyze the problem characteristics of Travelling sales man problem.
- (iii). Why is A* search superior to best first search?
- (iv) What do you understand by inferential efficiency in Knowledge representation method.
- (v) Define alpha-beta cut- off and their utility.
- (vi) Describe the control strategy of constraint satisfaction problem

[5x3]

Q2. Consider a state space where start space is number 1 and successor for state numbered n is $3n$ and $3n-1$. Draw the search tree. List the order in which nodes will be visited using following search techniques if goal node is numbered as 24

- (i) Depth first search, (ii) Iterative deepening search.

[2]

Q3. Explain the traversing of graph in fig 1 using AO*procedure

[2].

Q4. Work out first two steps of A* algorithm to solve Eight puzzle problem where initial state and goal state are described below:

| | | |
|---|---|---|
| 5 | 3 | 6 |
| 7 | . | 2 |
| 4 | 1 | 8 |

| | | |
|---|---|---|
| 3 | 7 | 6 |
| 5 | 1 | 2 |
| 4 | . | 8 |

[3]

Q5. Illustrate the steps of Minimax procedure to make a move for Maximizing player in response to following board position.

[3]

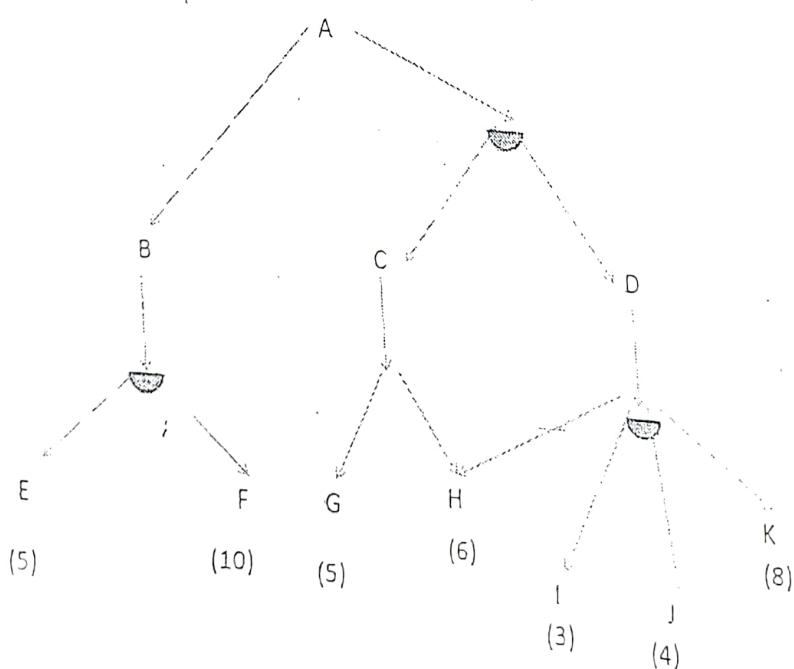
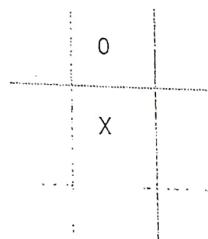


Fig.1

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Roll No.

SIXTH SEMESTER

B.Tech (IT)

MID SEMESTER EXAMINATION

(March-2018)

IT304 SOFTWARE ENGINEERING

Time: 1 Hour 30 Minutes

Max. Marks: 25

Note: Answer all questions.

Assume suitable missing data, if any.

1. Answer the following questions briefly:

- a) What do you mean by the statement "Software doesn't wear out"? Compare it with the failure intensity rate curve of the hardware.
- b) Explain the difference between functional and non-functional requirements?
- c) What are the differences between function-oriented design and object-oriented design?
- d) What is the purpose of a Data Flow Diagram (DFD)? Distinguish it from a flowchart.
- e) Explain why incremental development is the most effective approach for developing business software systems. Why is this model less appropriate for real-time systems engineering?

[3X5=15]

2. Explain the difference between module cohesion and module coupling. List any two types of technique each for cohesion and coupling. What is the relationship between cohesion and coupling?

[5]

P.T.O.

Suppose the university has decided to automate the student registration system that will replace a legacy system. The new system will allow students to register for courses and view report cards from personal computers attached to the campus LAN. Professors will be able to access the system to sign up to teach courses as well as record grades. The system must be able to use the existing course catalog database. Design a use case diagram for the above system. Explain any two use cases with the help of use case templates.

SIXTH SEMESTER

B.TECH (MC)

MID SEMESTER EXAMINATION

MARCH- 2018

MC 304 THEORY OF COMPUTATION

Time: 1.30 Hours

Max. Marks: 25

Note: Answer ALL.

Q1. Construct an NDFA accepting the set of all strings over $\{a, b\}$ ending in aba . Use it to construct a DFA accepting the same set of strings.

Q2. Construct a grammar which generates all even integers up to 998.

Q3. Show that the class of context free languages is closed under concatenation and union.

Q4. Show that $L = \{0^i 1^i : i \geq 1\}$ is not regular.

Q5. Construct a transition system corresponding to the regular expressions

$$(i) (ab + c^*)^*b \quad (ii) a + bb + bab^*a$$

1. (a) Define the term Software Engineering. (1 Mark)
- (b) Write two disadvantages of waterfall model. (2 Marks)
- (c) Differentiate between functional and non-functional requirements. (2 Marks)
2. (a) Describe the difference between conceptual design and technical design. (1 Mark)
- (b) Briefly explain data flow diagrams and give an example of level-0 DFD (2 Marks)
- (c) Describe the relationship between cohesion and coupling. (2 Marks)
3. Explain the spiral model of software development. What are the limitations of such a model? (5 Marks)
4. (a) Describe the various steps of requirements engineering. Is it essential to follow these steps? (2.5 Marks)
- (b) What is the degree of a relationship? Give an example of each of the relationship degree. (2.5 Marks)
5. Define module coupling and explain different types of coupling. (5 Marks)

Total no. of pages : 1

6th SEMESTER

MID SEMESTER EXAMINATION

Roll No. _____

B.Tech (MC- Engg.)

MAR 2018

MC – 306 Financial Engineering

Time : 90 mins

Max. Marks: 25

Note: Attempt all questions. All question carry equal marks.

Assume missing data , if any.

1. Let $B(0) = \text{Rs. } 100, B(1) = \text{Rs. } 110$ and $S(0) = \text{Rs. } 80$. Also, let
$$S(1) = \begin{cases} \text{Rs. } 100, & \text{with probability } p = 0.80 \\ \text{Rs. } 60, & \text{with probability } p = 0.20. \end{cases}$$
Design a portfolio with initial wealth of Rs.10,000, split in the ratio of 3:2 between stock and bond. Compute the expected return and the risk of the portfolio so constructed.
2. Let $S(0) = \text{Rs. } 120, u = 1.2, d = 0.9$ and $r = 1\%$. Consider a call option with strike price $K = \text{Rs. } 120$ and $T = 2$. Find the option price and the replicating strategy.
3. If $S(0)$ is the price of asset at $t = 0$, then prove that the forward price will be $F(0, T) = \frac{S(0)}{d(0, T)}$, $d(0, T)$ is the discount factor between at $t = 0$ to $t = T$.
4. A non-dividend paying stock is currently selling at Rs. 150 with annual volatility 20%. Assume the continuously compounded risk free interest rate is 4%. 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. 170 and time to expiration 3 years.
5. 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 19%. Call options are written with a strike price of Rs. 90 and time to expiration of 5 years. Use Black-Scholes formula to find the price of one such call option.

Total No. of Pages: 02

Roll No.

6th Semester

Mid Semester Examination

B. Tech. [MC]

(March-2019)

MC302 Database Management System

Time 1h 30 min.

Max. Marks: 30

NOTE: Attempt all Questions. Assume suitable missing data if any.

- Q1. A) What is the difference between primary key and unique constraints? [2]
B) What is the difference between delete and truncate command in SQL? [2]
C) What are the disadvantages of DBMS (any two)? [2]
D) Explain different data anomalies with example. [4]

Q2. Consider the following database schema to write queries in SQL

Supplier (Sid, name, city) [2 * 2.5 = 5 marks]

Parts (pno, pname, pdescription)

Supply (Sid, pno, cost)

i) Find the names of the parts supplied by “RamRaj”.

ii) Find the cheapest cost of every part. You can use part number (pno).

Q3. 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;
- 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. Construct an E-R diagram for the registrar's office. Document all assumptions that you make about the mapping constraints. [6 marks]

Q4. For each of the following relations, tell which normal form it is (none, 1NF, 2NF, 3NF, or BCNF) and why? If it is less than 3NF, give an equivalent 3NF schema. [2 * 2 = 4 marks]

A) **Rentals** [SailorId, SailorName, BoatId, Date]

[SailorId, BoatId, Date] is the primary key.

SailorId → SailorName.

b) **Customers** [Id, Name, Address, PhoneNumbers]

PhoneNumbers is a comma-delimited list. Id and Name are keys.
There are no other FDs.

Q5. Suppose we have a database for an investment firm, consisting of the following attributes:

B – Broker,

[2 * 2.5 = 5 marks]

I – Investor,

O – Office of a broker,

Q – Quantity of stock owned by an investor,

D – dividend paid by a stock,

Hence, the overall schema is R = (B, O, I, S, Q, D).

S – Stock.

Assume that the following FDs are required to hold on this database
I → B, IS → Q, B → O, S → D.

1) List all the candidate keys for R.

2) Give a lossless-join decomposition of R into 3NF preserving FD.

-- END --

MID SEMESTER EXAMINATION

March-2019

MC304 THEORY OF COMPUTATION

Time: 1:30 Hours

Max. Marks : 25

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

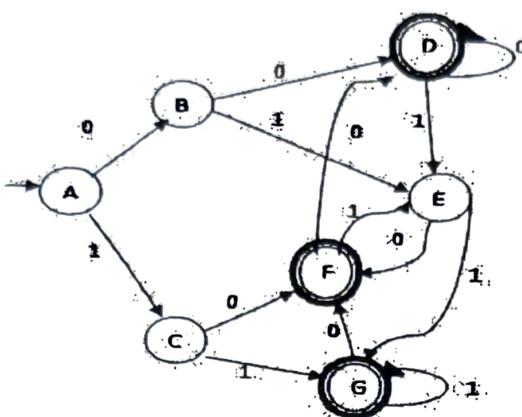
Q.1 [a] Choose the correct answer. Justify (3)

- i. Which of the following is a regular expression for binary strings with no consecutive 1's ?
 - a) $(01 + 10)^*$
 - b) $(1 + \lambda)(01 + 0)^*$
 - c) $(0 + 1)^*(0 + \lambda)$
 - d) $(10 + 0)^*(1 + \lambda)^*$
- ii. Which of the following is the language of the grammar:
$$S \rightarrow bS|aA|b ; A \rightarrow bA|aB ; B \rightarrow bB|aS|a$$
 - a) Number of a's is more than three times the number of b's.
 - b) Number of b's is more than three times the number of a's.
 - c) Number of a's is multiple of 3.
 - d) Number of b's is multiple of 3.
- iii. The smallest finite automata that accepts all non-negative binary numbers divisible by 3 has:
 - a) 2 states
 - b) 3 states
 - c) 4 states
 - d) 5 states

[b] What is the length of output string if the length of input string is n, in case of Mealy and Moore machine. Explain. (2)

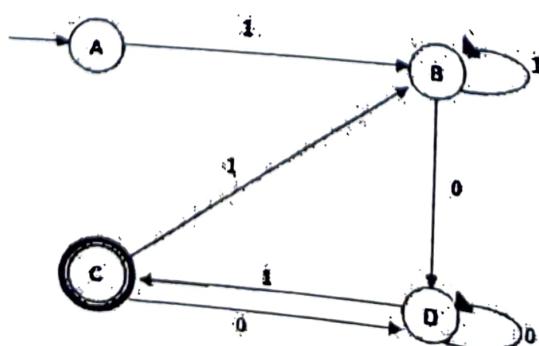
P.T.O.

Q.2 [a] Construct a minimum state automata equivalent to the transition diagram below: (5)



[b] Construct a Finite Automata that accept the set of all inputs that are binary numbers divisible by 4 or by 6. (5)

- Q.3 [a] Show that all the language under Chomsky classification are closed under concatenation. (4)
- [b] If R is a regular expression over Σ representing $L \subset \Sigma^*$, construct an NDFA M with λ -moves such that $L = T(M)$, where last operator in R is concatenation. (3)
- [c] Find the regular expression corresponding to the automata given below: (3)



MC – 306 Financial Engineering

Time : 90 mins

Max. Marks: 25

Note: Attempt all questions. All question carry equal marks.

Assume missing data , if any.

1. Let $B(0) = \text{Rs. } 100, B(1) = \text{Rs. } 105$ and $S(0) = \text{Rs. } 75$. Also, let
$$S(1) = \begin{cases} \text{Rs. } 88, & \text{with probability } p = 0.60 \\ \text{Rs. } 69, & \text{with probability } p = 0.40. \end{cases}$$
Design a portfolio with initial wealth of Rs.5, 000, split in the ratio of 2:3 between stock and bond. Compute the expected return and the risk of the portfolio so constructed.
2. Let $S(0) = \text{Rs. } 110, u = 1.1, d = 0.9$ and $r = 5\%$. Consider a call option with strike price $K = \text{Rs. } 130$ and $T = 2$. Find the option price and the replicating strategy.
3. If $S(0) = A(0)$, then prove that $S^d < A(1) < S^u$, or else an arbitrage opportunity would arise.
4. A non-dividend paying stock is currently selling at Rs. 125 with annual volatility 18%. Assume 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. 160 and time to expiration 3 years.
5. The stock price is Rs. 80. The annual continuously compounded risk free interest rate is 7% and the annual volatility relevant for the Black-Scholes formula is 14%. Call options are written with a strike price of Rs. 75 and time to expiration of 3 years. Use Black-Scholes formula to find the price of one such call option.

Time: 1:30 Hours

Max. Marks: 25

Note: All questions are compulsory.

1. (a) What is Software Development Life Cycle (SDLC)? (1 mark)
(b) Describe briefly the characteristics of software as a product. (2 marks)
(c) What are functional and non-functional requirements? (2 marks)

2. (a) What is the role of data dictionary? (1 mark)
(b) Differentiate between SRS document and design document. (2 marks)
(c) State two disadvantages of spiral model of software development. (2 marks)

3. (a) In the context of object-oriented design, explain the concept of abstraction. (2 marks)
(b) Describe the various steps of requirements engineering process. (3 marks)

4. Define module cohesion and explain different types of cohesion. (5 marks)

5. Explain the different phases involved in waterfall model. Mention its drawbacks. (5 Marks)

END

Total No. of Pages: 03

Roll No.:

B.Tech. VI Semester

Mid Sem. Exam. 2019

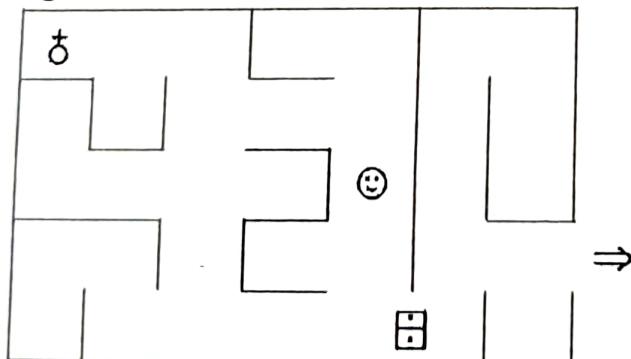
Subject Code: MC 312 Course Title: Artificial Intelligence

Time: 1 Hour 30 Minutes

Max. Marks: 30

Answer all questions. (Assume suitable missing data, if any.)

1. What is Artificial Intelligence? Discuss about 7-problem characteristics for Missionaries and Carnivals Problem. The definition of the problem is "In Missionaries and Carnivals Problem, initially there are some missionaries and some carnivals (boatman, Grass, Tiger and Goat) will be at a side of a river. They want to cross the river. But there is only one boat available to cross the river. The capacity of the boat is 2 and no one missionary or no Carnivals can cross the river together". Give state space representation and production rule to solve the problem. (2+2+4)
2. You (☺) are trapped in a maze and needs to escape from it. Unfortunately there is a locked door between you and the exit, and you have to take the key (♀) before you can unlock the door. You are not facing any special direction and can move one step in any direction at any time step, as long as there is no wall in the way. Alternatively you can pick up the key (if you are in the right location), or you can unlock the door (if you have the key and are in the right location). Neither the key nor the door can move around on their own. Your goal is to find a plan for escaping the maze using as few moves as possible. Assume that the grid has size $M \times N$.



Give a suitable representation of the states in this searching problem. What is the size of the state space?

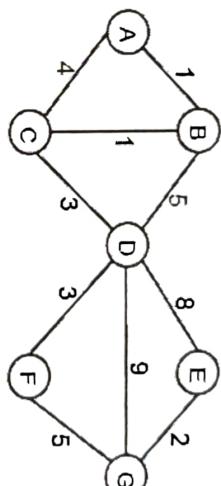
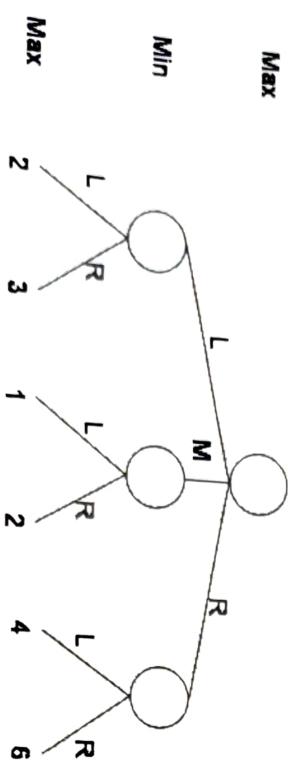
(4)
P.T.O

3. Convert the following facts into equivalent predicate (3)

- i. John likes all kinds of food.
- ii. Apples are food.
- iii. Chicken is food.
- iv. Anything anyone eats and isn't killed by is food.
- v. Bill eats peanuts and is still alive
- vi. Sue eats everything Bill eats.

4. Consider the game tree shown below. The top node is a max node. The labels on the arcs are the moves. The numbers in the bottom layer are the values of the different outcomes of the game to the max player.

- a. What is the value of the game to the max player?
- b. What first move should the max player make?
- c. Assuming the max player makes that move, what is the best next move for the min player, assuming that this is the entire game tree?
- d. Using alpha-beta pruning, consider the nodes from right to left, which nodes are cut off? Circle the nodes that are not examined. (6)



| Node | h1 | h2 |
|------|-----|-----|
| A | 9.5 | 10 |
| B | 9 | 12 |
| C | 8 | 10 |
| D | 7 | 8 |
| E | 1.5 | 1 |
| F | 4 | 4.5 |
| G | 0 | 0 |

A. For each of the following graph search strategies (do not answer for tree search), mark which, if any, of the listed paths it could return. Note that for some search strategies the specific path returned might depend on tie-breaking behavior. In any such cases, make sure to mark all paths that could be returned under some tie-breaking scheme. (3)

| Search Algorithm | A-B-D-G | A-C-D-G | A-B-C-D-F-G |
|-----------------------------|---------|---------|-------------|
| Depth first search | | | |
| Breadth first search | | | |
| A* search with heuristic h1 | | | |
| A* search with heuristic h2 | | | |

B. Suppose you are completing the new heuristic function h3 shown below. All the values are excepted except h3(B). What values of h3(B) will cause A* graph search to expand node A, then node C, then node B, then node D in order? (3)

| Node | A | B | C | D | E | F | G |
|------|----|---|---|---|-----|-----|---|
| h3 | 10 | ? | 9 | 7 | 1.5 | 4.5 | 0 |

5. Consider the state space graph shown. A is the start state and G is the goal state. The costs for each edge are shown on the graph. Each edge can be traversed in both directions. Note that the heuristic h1 is consistent but the heuristic h2 is not consistent.

All the best

Time: 01:30 Hours

Note: All questions are compulsory.
Assume suitable missing data, if any.

- 1 [a] Differentiate between verification and validation with examples? (3)
[b] List out requirement elicitation techniques. Which one is most popular and why? (4)
[c] What is the practical application of function point method? (2)
[d] What is cohesion? Explain best and worst type of cohesion. (4)
[e] Why is the sum of μ_p and τ_p in COCOMO model not equal to 1? (2)
- 2 Describe iterative enhancement model. Discuss each phase in detail. (3)

3 The aim is to develop a Delhi Metro Automation System (DMAS). The DMAS has the following functions:

- Token and smart card: to use the metro train, every passenger is required to have a valid token or a smart card.
 - The duration of a token or a smart card is 10 minutes from the time of entry, if an exit is performed after 120 minutes a fine of Rs.50 is imposed.
 - A token can be used to exit from stations where the fare exactly matches the amount in the token, a smart card does not have this restriction.
 - Smart card carries a discount of 10% on all transactions.
 - To refill a smart card: maximum limit: Rs.800, minimum limit : Rs.50, and denomination have to be in multiples of Rs. 50.
 - To enter a station, the minimum balance on the smart card should be rupees.
 - If the fare exceeds the balance present in the card, the balance can go negative upon exit.
- Metro train: Every metro train runs between source and destination.

P.T.O.

- For each station there is a button, Station alert is shown by illumination of buttons. All buttons are illuminated when the metro train begins from the source station. The button illuminates with blinking light on the next coming station. The blinking illumination is cancelled when the metro visits the desired station and then the button for next station blinks.
- Closing of doors is mandatory for any movement of train.
- Door opening time is 30 seconds in ideal conditions. In case of any obstruction the system will attempt to clear the door 3 times, if obstruction persists, all the doors will be open on all coaches and again they are tried to close.
- Reporting: The following reports are maintained during metro operation:
 - Entry, exit times along with stations for all tokens.
 - Fine collected along with reasons.
 - Daily collection of money.
 - Number of customers that travel per day

Schedule of all trains are maintained.

Draw the following using standard notations. If necessary, you can make suitable assumptions regarding the details of various features of DMAS, but you must clearly write down the assumptions you make.

1. Draw context level diagram. (2)
2. Draw level-1 DFD for the DMAS. (5)
3. Draw level-2 DFD for purchase smart card process. (5)

END

Total no. of pages: 02

FOURTH SEMESTER

MID TERM EXAMINATION

SE206 DATABASE MANAGEMENT SYSTEM

Time: 01:30 Hours

Roll No.....

B. Tech. [SE]

March- 2019

Max. Marks: 30

NOTE: Attempt any 4 questions.

Que 1. (a) Define the terms: database, DBMS and DBA.

(b) Discuss the main characteristics of the database approach and how it differs from traditional file system. (3+4.5)

Que 2. (a) What do understand by data models? Explain various data models in detail.

(b) Explain any 3 of the following terms with example: IS-A relationship, specialization, spurious tuples, difference in super key and key. (3+4.5)

Que 3. (a) 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, social security number, current address and phone, permanent address and phone, birthdate, sex, class (freshman, sophomore, . . . , graduate), 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 social security number and student number have unique values for each 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 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 an 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: for any unspecified requirements, and make appropriate assumptions to make the specification complete.

(b) Differentiate between Relational Schema and Instance.

(6+1.5)

Que 4. (a) Define Normalization, 2NF and 4NF.

(b) Consider the universal relation $R = \{A, B, C, D, E, F, G, H, I, J\}$ and the set of functional dependencies $F = \{AB \rightarrow C, A \rightarrow DE, B \rightarrow F, F \rightarrow GH, D \rightarrow IJ\}$. What is the key for R? Decompose R into 2NF, then 3NF relations. Are these Decomposition attribute preserving and Lossless decomposition?

(3+4.5)

Que 5. Consider the following relations for a database that keeps track of auto sales in a car dealership (Option refers to some optional equipment installed on an auto):

CAR(Serial-No, Model, Manufacturer, Price)

OPTIONS(Serial-No, Option-Name, Price)

SALES(Salesperson-id, Serial-No, Date, Sale-price)

SALESPERSON(Salesperson-id, Name, Phone)

a. First, specify the foreign keys for the above schema, stating any assumptions you make.

b. Then specify the following queries in relational algebra:

i. For the salesperson named 'Jane Doe', list the following information for all the cars she sold: Serial#, Manufacturer, Sale-price.

ii. List the Serial# and Model of cars that have no options.

iii. Consider the natural join operation between SALESPERSON and SALES. What is the meaning of a left outer join for these tables (do not change the order of relations). Explain with an example.

iv. List the name of salesperson who have sold all models of Audi. (Audi is a car manufacturer)

(1.5+6)

CO202 Database Management System
Duration: 1.5 Hrs. **Max Marks: 30**

NOTE: Attempt all the questions. Assume the missing data if any.

Q1. Given the relational schemas: (2.5x2)

employee (person_name, street, city)
works (person_name, company_name, salary)
company (company_name, city)
manages (person_name, manager_name)

Give the expressions in relational algebra with explanation for the following queries:

- Find the names of all employees who live in the same city and on the same street as do their managers.
- Give all managers in this database a 20 percent salary raise.

Q2. Using a two-dimensional array of size n x m, illustrate the differences (a) in the three levels of data abstraction and (b) between a schema and instances. (4)

Q3. Draw an ER diagram for a garment manufacturing company. The entity includes warehouses, production units, marking wing, vendor and product types. Define the relationship between each of these entities and take the appropriate attributes. (6)

Q4. a) Explain the normal forms due to functional dependencies. (5)
(b) Consider the following relation schema and set F of functional dependencies

$$R = (A, B, C, D, E). \quad (5)$$

$$\begin{array}{l} A \rightarrow BC \\ CD \rightarrow E \\ B \rightarrow D \\ E \rightarrow A \end{array}$$

List the candidate keys for R.

Q5. Differentiate between:

- a) Procedural and non-procedural DMLs
- b) Disjoint and overlapping generalization

END

Total No. of Pages: 2

VITH SEMESTER

MID SEMESTER EXAMINATION

Roll No.....

B.Tech.(Computer Engineering)

(March, 2019)

CO304

Paper Code

Time: 1:30 Hours

ARTIFICIAL INTELLIGENCE

Max. Marks: 25

Note: Answer all questions.

Assume suitable missing data, if any.

Q1. Answer to the point following:

- (i) Describe the characteristics of the control strategy. Is breadth first search a control strategy? justify .
- (ii) Compare and contrast Depth first search and Hill Climbing.
- (iii) Define the term admissibility of a search procedure. Which search procedure is admissible?
- (iv) Which problem solving approach used in Means End Analysis search procedure?

[4x2]

Q2. (i) Why best search is better than hill climbing

(ii) Work out few steps of A* algorithm for slide back puzzle having following moves.

I. A tile may move to adjacent cell with unit cost

II. A tile may hope another tile with a cost of 4

Initial and goal nodes are described as:



(iii) Design the procedure to revise cost upward of AO*algorithm and illustrate the steps using suitable search tree

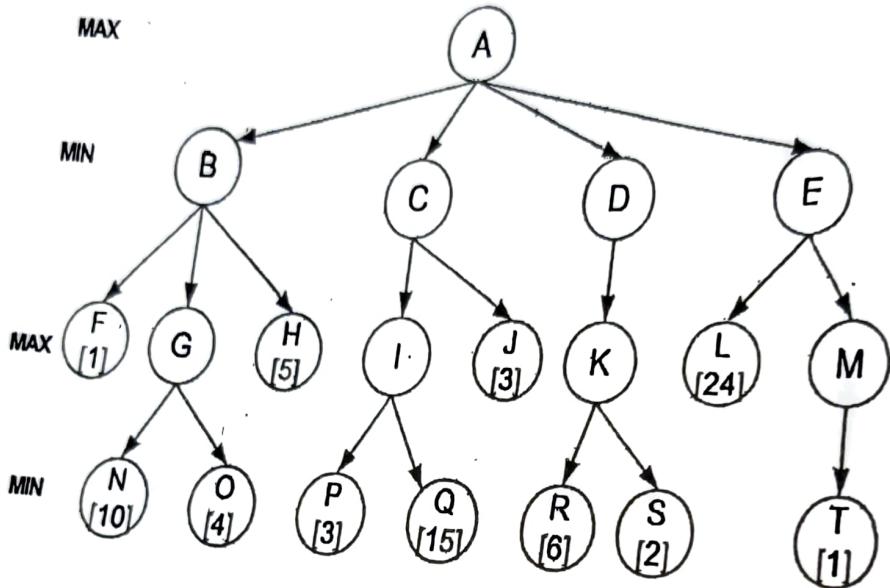
[2,4,4]

Q3. For the graph in Fig (1), find the max value at the root node by applying mini max search. Also show alpha beta pruning.

Q4. (i) Represent the sentence in clause form: Any student who is intelligent or hard working gets a good placement

(ii) Given fact: $A \rightarrow (B \wedge C)$ and A, Use resolution procedure to prove that B is true.

[2,2]



Fig(1)

Total No. of Pages: 2

Roll No.....

SIXTH SEMESTER

B. Tech.

MID SEMESTER EXAMINATION

March-2019

IT304 Software Engineering

Time: 1:30 Hours

Max. Marks: 25

Note: All questions are compulsory. Assume suitable missing data, if any.

Q.1

- a) Why the documentation is given importance in software development?
- b) Distinguish between functional, non functional and domain requirements with example.
- c) What is the use of Data Dictionaries? Explain with example.
- d) What are the issues addressed by SRS writers? What are the characteristics of good SRS?

[1.5*4=6]

Q.2 Compute the function point value for a project with the following information domain characteristics.

Number of user input=30

Number of user outputs=42

Number of user enquiries=08

Number of files=07

Number of external interfaces=6

Assume that all weighting factors as average complexity adjustment values are moderate.

[5]

Q.3 What is requirement elicitation? Explain any two techniques

[3]

Q.4 (Suppose) DTU engineers team has launched an "Automated Book Management System" (ABMS) which aims to provide any course or extra books on demand by students on rental basis. Students are provided with their account ID to login and can search for the respected book they need. Books are managed in the warehouse by a manager and are collected in the store by vendor. Every student on renting a book will be provided an invoice which will act as a token for submitting the book further. New Students or users are mandatory to login with 6 month subscription. Student accounts are linked with the ERP of college (to maintain integrity). If any user don't make to return the book on time, an alert on erp will be notified and late charges will be applied on return. Money collected will be used by the team members for college fest preparations and charity in future.

The purpose of the above system is to provide large collection of respectable course books and not to challenge library management. On the basis of above data, draw a neat and labeled

- (i) ER diagram
- (ii) DFD-O level

Q.5 Explain the phases of Spiral Model with detailed diagram. What does its radial and angular dimension represents? [3+3=6]

[5]

-END-

Total No. of Pages: 03

B. Tech. [MC]

Supplementary End Semester Examination

MC-302 Database Management System

Time 3h 00 min.

Roll No.

6th Semes

(August-2018)

Max. Marks: 40

NOTE: Attempt any FIVE Questions. Assume suitable missing data if any.

Q1. Differentiate between the following: [3+3+2]

A) Database Instance and Database Schema.

B) Data Definition Language and Data Manipulation Language.

c) Primary key and Candidate Key.

Q2. Consider the relation Instructor (Id, Name, Deptt_name, Salary). Write SQL instructions for the following: [3+3+2]

a) Give a 5% salary raise to instructors whose salary is less than the average of all the instructors.

b) Delete all tuples in the instructor relation pertaining to instructors in the Finance department.

c) Find average salary in each department.

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F
1

Q3. Consider the following relational schema for a library: [3+3+2]

Member (memb_no, name, dob)

Books (isbn, title, authors, publisher)

Borrowed (memb_no, isbn, date)

Write the following queries in relational algebra

a) Find the name of members who have borrowed any book published by “McGraw-Hill”.

- b) Find the name of members who have borrowed all books published by
 "McGraw-Hill".
 c) find the average number of books borrowed per member.

Q4. A) What is mapping cardinality? Give all its types with examples. [6]

B) Explain the differences among an entity, an entity type and an entity set. [2]

Q5. A) Construct an E-R diagram for a car insurance company whose customers own one or more cars each. Each car has associated with it zero to any number of recorded accidents.

B) List and explain all functional dependencies satisfied by the following relation.

[4]

| A | B | C |
|----|----|----|
| a1 | b1 | c1 |
| a1 | b1 | c2 |
| a2 | b1 | c1 |
| a2 | b1 | c3 |

Q6. A) Normalize the following schema, with given constraints, to 4NF.

Books (accession_no, isbn, title, author, publisher)

Users (userid, name, deptid, deptname)

Accession_no → isbn

isbn → title

isbn → publisher

isbn → author

userid → name

userid → deptid

deptid → deptname

B) Consider the following set F of functional dependencies on the relation schema r(A,B,C,D,E):
 $A \rightarrow BCD$, $BC \rightarrow DE$, $B \rightarrow D$, $D \rightarrow A$

- i) Compute B^+ .
 ii) Compute a canonical cover for the above set of functional dependencies F; give each step of your derivation with an explanation.
 iii) Give a 3NF decomposition of r based on the canonical cover.

Q7. A) Construct a B^+ Tree for the following set of key values:

(2, 3, 5, 7, 11, 17, 19, 23, 29, 31)

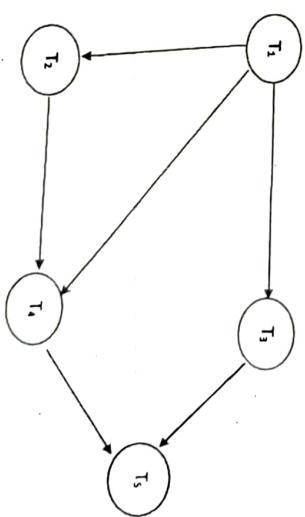
Assume that the tree is initially empty and the values are added in ascending order. Construct a B^+ tree for the case where number of pointers that will fit in one node is 4.

B) What is the difference between a clustering index and a secondary index.

[4]

Q8. A) List the ACID properties. Explain the usefulness of each.

B) Consider the following precedence graph. Is the corresponding schedule conflict serializable? Give reasons also.



[4]

Total No. of pages. 03
SIXTH SEMESTER

Roll No.....
B.TECH (MC)

SUPPLEMENTARY EXAMINATION AUGUST 2018

MC-304 THEORY OF COMPUTATION

Time: 3 Hours

Max.Marks: 50

Note:Answer **ALL** by selecting any **TWO** parts from each question.
All questions carry equal marks.

Q1(a) Prove that if L is the set accepted by NDFA, then there exists a DFA which also accepts L .

(b) Construct a DFA equivalent to $M = (\{q_0, q_1\}, \{0, 1\}, \delta, q_0, \{q_0\})$, where δ is defined by the state table:

| State/ Σ | 0 | 1 |
|-----------------|-------|------------|
| q_0 | q_0 | q_1 |
| q_1 | q_1 | q_0, q_1 |

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(c) Prove by mathematical induction that for any transition function δ and for any two input strings x and y ,

$$\delta(q, xy) = \delta(\delta(q, x), y)$$

Q2(a) State and prove Arden's theorem.

(b) State whether the following statements are true or false. Justify your answer with a proof or a counter example.

- (i) If G_1 and G_2 are equivalent, then they are of the same type.
- (ii) If L is a finite subset of Σ^* , then L is a context free language.
- (iii) If L is a finite subset of Σ^* , then L is a regular language.

(c) Let $M = (Q, \Sigma, \delta, q_0, F)$ be a finite automata. Let R be a relation in Q defined by $q_1 R q_2$ iff $\delta(q_1, a) = \delta(q_2, a) \forall a \in \Sigma$. Is R an equivalence relation? Justify the answer. Also prove that if

$\delta(q, x) = \delta(q, y)$ then $\delta(q, xz) = \delta(q, yz) \forall z \in \Sigma$.

Q3(a) State and prove Kleene's theorem. Construct a finite automaton

equivalent to the regular expression $a^*(ba^*)^*$.

(b) Construct a reduced grammar equivalent to the grammar

$$S \rightarrow aAa, A \rightarrow Sb/bCC/DaA, C \rightarrow abb/DD, E \rightarrow aC, D \rightarrow aDA.$$

(c) Define ambiguity in CFG. Prove that a regular grammar cannot be ambiguous.

Q4(a) State and prove Pumping lemma for context free language.

(b) Show that the class \mathcal{L}_{rl} is closed under union where \mathcal{L}_{rl} denotes the family of regular languages.

(c) Reduce the following grammar to GNF:

$$S \rightarrow AB, A \rightarrow BSB, A \rightarrow BB, B \rightarrow aAb, B \rightarrow a, A \rightarrow b.$$

END

Q5 (a) Prove that if PDA $A = (Q, \Sigma, \Gamma, \delta, q_0, Z_0, F)$ accepts L by final state then, we can find a PDA 'B' accepting L by empty store i.e. $L = T(A) = N(B)$.

(b) In how many ways a Turing machine can be described? Explain with suitable examples.

(c) Consider the Turing machine description given below

| Present State | Tape Symbols | | |
|---------------|--------------|---------|---------|
| q_1 | b | 0 | 1 |
| q_2 | | $1Lq_2$ | $0Rq_1$ |
| q_3 | - | bRq_3 | $0Lq_2$ |
| q_4 | | | $1Lq_2$ |
| q_5 | | $0Rq_5$ | bRq_4 |
| | | $0Rq_4$ | bRq_5 |
| | | - | $1Rq_4$ |

Draw the transition diagram of the TM. Draw the computation for the string 00.

Total no. of pages :1

6th SEMESTER

SUPP EXAMINATION

MC – 306 Financial Engineering

Time : 3 hrs

Roll No. _____

B.Tech (MC- Engg.)

Aug 2018

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) Let $A(0) = 90, A(1) = 95, S(0) = 25$ dollars and let
 $S(1) = \begin{cases} 32 & \text{with probability } p, \\ 22 & \text{with probability } 1 - p, \end{cases}$
where $0 < p < 1$. For a portfolio with $x = 10$ shares and $y = 15$ bonds calculate $V(0), V(1)$ and K_V
(b) An investor paid \$92 for a bond with face value \$100 maturing in six months. When will the bond value reach \$98 if the interest rate remains constant?
(c) Find the stochastic differential of $\cos(W(t))$.
(d) The stock price is Rs.200. A 6-month European call option on the stock with strike price Rs.250 is priced using Black-Scholes formula. It is given that the continuously compounding risk free rate is 5%, stock pays no dividend. The volatility of the stock is 20%. Determine the price of call and put options.
2. (a) Let $S(0) = \text{Rs.}80, r = 10\%, u = 0.2$ and $d = -0.1$. Find the price of a European call and put with strike price $X = \text{Rs.}100$ to be exercised after $N = 2$ time steps using CRR- formula.
(b) Consider the following data
 $S(0) = \text{Rs.}50, K = \text{Rs.}50, \sigma = 30\%, r = 8\%$. Assuming the Black Scholes frame work and that the stock pays no dividend, compute 3-months European call price and 3-months European put price

using the Black-Scholes formula.

3. (a) Let $\{S_n, n = 0, 1, \dots\}$ be a symmetric random walk and F_n be a filtration. Show that $Y_n = (-1)^n \cos(\pi S_n)$ is a martingale with respect to F_n .
- (b) $\{N(t), t \geq 0\}$ be a Poisson process with parameter λ . Prove that, $\{N(t), t \geq 0\}$ is not a Martingale.
4. (a) If $S(0)$ is the price of asset at $t=0$, then prove that the forward price will be
$$F(0, T) = \frac{S(0)}{d(0, T)}$$
 $d(0, T)$ is the discount factor between $t=0$ to $t=T$.
(b) Let $A(0) = 100, A(1) = 110, S(0) = \text{Rs.}100$, strike price $\text{Rs.}90$ and
 $S(1) = \begin{cases} 115 & \text{with probability } 0.7 \\ 85 & \text{with probability } 0.3 \end{cases}$
find put option price.

5. (a) Prove that portfolio with minimum risk has weights given by
$$w = \frac{e^{-T} e}{e^T C^{-1} e},$$
 where C is variance and covariance matrix, and $e^T = (1, 1, \dots, 1) \in R^n$

- (b) Using the following data:

| Scenario | Probability | Return K1 | Return K2 |
|-------------------------|-------------|-----------|-----------|
| ω_1 (recession) | 0.3 | -10% | 20% |
| ω_2 (stagnation) | 0.3 | 0% | 20% |
| ω_3 (boom) | 0.4 | 20% | 10% |

Find the weights in a portfolio with expected return $\mu_V = 40\%$ and compute the risk of this portfolio

MC 310: Software Engineering

Time: 3 Hours

Max. Marks: 50

Note: Attempt any five questions. Each question carries equal marks.
Assume missing data suitably (if any).

1. (a) Compare iterative enhancement model with evolutionary process model.
(b) Explain the use case approach of requirements elicitation. What are use case guidelines?
2. (a) What is the degree of a relationship? Give an example of each of the relationship degree.
(b) Explain the concept of function points. Why function points are becoming acceptable in the industry?
3. (a) Write short notes on the following:
(i) Data flow diagrams
(ii) Data dictionary
(b) Discuss various types of COCOMO mode. Explain phase wise distribution of effort.
4. (a) Discuss the objectives of modular software design. What are the effects of module coupling and cohesion?
(b) Write a program for the calculation of roots of a quadratic equation in any programming language and find out all software science metrics for the program.

- 40 -

5. (a) Describe McCall software quality model. How many product quality factors are defined and why?
- (b) What is the difference between:
(i) Development and regression testing.
(ii) Functional and structural testing.
6. (a) What are various kinds of functional testing? Describe any one in detail.
- (b) Explain Logarithmic Poisson Execution Time model of software reliability.

Or

Explain basic execution time model of software reliability.

Total No. of pages. 03

ROLL NO.....
B.TECH(MC)

SURREY ELEMENTARY EXAMINATION

SUPPLEMENTARY MATERIALS

Time: 3 Hours

Max.Marks: 70

Note: Answer **ALL** by selecting any **TWO** parts from each question.
All questions carry equal marks.

Q1(a) Define Moore machine. Construct a Moore machine equivalent to the Mealy machine defined by the table below:

| 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 |

— ٤٤ —

- (b) Construct a nondeterministic finite automaton accepting the set of all strings over $\{a, b\}$ ending in aba . Use it to construct a DFA accepting the same set of strings.

(c) Define equivalence of two states in a finite automaton. Prove that two states q_1 and q_2 are $(k+1)$ -equivalent if they are k -equivalent and $\delta(q_1, a)$ and $\delta(q_2, a)$ are also k -equivalent for every $a \in \Sigma$.

(Z(a)) Let $G = (\{S, A\}, \{0, 1, 2\}, P, S)$, where P consists of

$S \rightarrow 0SA2, S \rightarrow 012, 2A \rightarrow A2, 1A \rightarrow 11$: Show that

$$L(G) = \{0^n 1^n 2^n : n \geq 1\}.$$

- (b) Let L be the set of all palindromes over $\{a,b\}$. Construct a grammar G generating L .
- (c) Show that the family of context sensitive languages is closed under concatenation and union.
- Q3(a) Write the steps needed for proving that a given set is not regular and hence show that $\{a^i b^i : i \geq 1\}$ is not regular.
- (b) If L is a regular set over Σ , then show that $\Sigma^* - L$ and L^T are also regular.
- (c) Define ambiguity in CFG. Prove that a regular grammar cannot be ambiguous.

Q4(a) Find a grammar in CNF equivalent to

$$S \rightarrow aAbB, \quad A \rightarrow aA/a, \quad B \rightarrow bB/b.$$

(b) Construct a grammar in GNF equivalent to the grammar

$$S \rightarrow AA/a, \quad A \rightarrow SS/b.$$

(c) State and prove Pumping lemma for context-free languages.

Q5(a) Prove that if L is a context-free language, then we can construct a pda 'A' accepting L by null store.

(b) Construct a pda A accepting $L = \{wcw^T : w \in \{a,b\}^*\}$ by final state.

(c) Consider the Turing machine description given below

| Present State | Tape Symbols | | |
|---------------|--------------|---------|---------|
| | b | 0 | 1 |
| q_1 | $1Lq_2$ | $0Rq_1$ | - |
| q_2 | bRq_3 | $0Lq_2$ | $1Lq_2$ |
| q_3 | - | bRq_4 | bRq_5 |
| q_4 | $0Rq_5$ | $0Rq_4$ | $1Rq_4$ |
| q_5 | $0Lq_2$ | - | - |

Draw the transition diagram of the TM. Draw the computation for the string 00.

END