B) Consider the transactions T1, T2, and T3 and the schedules S1 and S2 given below. Draw the serializability (precedence) graphs for S1 and S2 and state whether each schedule is serializable or not. If a schedule is serializable, write down the equivalent serial schedule(s). [4 marks]

```
T1: r1(X); r1(Z); w1(X); w1(Z)
T2: r2(Y); r2(Z); w2(Z)
T3: r3(Y); r3(X); w3(Y)
S1: r1(X); r3(Y); r3(X); r2(Y); r2(Z);
    w3(Y); w2(Z); r1(Z); w1(X); w1(Z)
S2: r1(X); r3(Y); r2(Y); r3(X); r1(Z);
    r2(Z); w3(Y); w1(X); w2(Z); w1(Z)
```

Q7. Write short note on any two of the following: [8 marks]

a) Primary Index

b) Secondary index

c) View Serializable Schedule

(4)

*Total No. of Pages: 04* *Roll No. ... .....*

**B. Tech. [MC]** **6th *Semester***

**End Semester Examination** ***(May-2018)***

***MC-302 Database Management System***

***Time 3h* 00 min.** ***Max. Marks: 40***

**NOTE:** *Attempt any five Questions. Assume suitable missing data if any.*

Q1. A) Consider a university database for the scheduling of classrooms for final exams. This database could be modelled as the single entity set exam, with attributes course-name, section-number, room-number, and time. Alternatively, one or more additional entity sets could be defined, along with relationship sets to replace some of the attributes of the exam entity set, as

- course with attributes: name, department, and c-number
- section with attributes: s-number and enrolment, and dependent as a weak entity set on course
- room with attributes: r-number, capacity, and building

Show an E-R diagram illustrating the use of all three additional entity sets listed. [5 marks]

B) What is an entity type? What is an entity set? Explain the differences among an entity, an entity type, and an entity set. [3 marks]

Q2. A) Consider the following Resort, Suite, Reservation and Visitor schemas in a DBMS. [6 marks]

RESORT (resortNo, resortName, resortType, resortAddress, resortCity, numSuite)

SUITE (suiteNo, resortNo, suitePrice)

RESERVATION (reservationNo, resortNo, visitorNo, checkIn, checkout, totalVisitor, suiteNo)

Visitor (visitorNo, firstName, lastName, visitorAddress)

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(1)

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i) Write the SQL to list full details of all the resorts in Jaipur.
ii) Write the SQL to list full details of all the resorts having number of suites more than 30.
iii) Write the SQL to list visitors in ascending order by first name.

B) How does SQL allow implementation of the entity integrity and referential integrity constraints? [2 marks]

Q3. A) Consider the relation: BOOK (Book_Name, Author, Edition, Year). With the data: [5 marks]

| Book_Name | Author | Edition | Copyright_Year |
|---|---|---|---|
| DB_fundamentals | Navathe | 4 | 2004 |
| DB_fundamentals | Elmasri | 4 | 2004 |
| DB_fundamentals | Elmasri | 5 | 2007 |
| DB_fundamentals | Navathe | 5 | 2007 |

a) Based on the common sense understanding of the above data, what are the possible candidate keys for this relation?
b) Justify that this relation has the MVD {Book_Name} $\rightarrow\!\!\!\rightarrow$ {Author}| {Edition, Year}.
c) What would be the decomposition of this relation based on the above MVD? Evaluate each resulting relation for the highest normal form it possesses.

B) Consider the universal relation R = {A, B, C, D, E, F, G, H, I, J} and the set of functional dependencies F = {{A, B} -> {C}, {A} -> {D, E}, {B} -> {F}, {F} -> {G, H}, {D} -> {I, J}}. What is the key for R? Decompose R into 2NF, then 3NF relations. [3 marks]

Q4. A) Consider a disk with block size B=512 bytes. A block pointer is P=6 bytes long, and a record pointer is PR =7 bytes long. A file has r=30,000 EMPLOYEE records of fixed-length. Record size R = 115 bytes long.

(a) Calculate the blocking factor *bfr* and the number of file blocks b assuming an unspanned organization.

(b) Suppose the file is ordered by the key field SSN of size 9 bytes and we want to construct a primary index on SSN. Calculate
(i) the index blocking factor $bfr_i$ (which is also the index fan-out *fo*);
(ii) the number of first-level index entries and the number of first-level index blocks;
(iii) the number of levels needed if we make it into a multi-level index;
(iv) the total number of blocks required by the multi-level index; and
(v) the number of block accesses needed to search for and retrieve a record from the file--given its SSN value--using the primary index. [6 marks]

B) A STUDENT file with Rollno as the key field includes records with the following Rollno values: 70, 15, 20, 35, 18, 55, 43. Suppose that the search field values are inserted in the given order in a B+ tree of order p=3; show the tree after inserting these values. [2 marks]

Q5. A) List the ACID properties. Explain the usefulness of each. [4 marks]

B) When a transaction is rolled back under timestamp ordering, it is assigned a new timestamp. Why can it not simply keep its old timestamp? [2 marks]

C) Under what conditions is it less expensive to avoid deadlock than to allow deadlocks to occur and then to detect them? [2 marks]

Q6. A) Consider the two tables T1 and T2 shown in figure. Show the results of the following questions: [4 marks]

Table T1

| P | Q | R |
|---|---|---|
| 10 | a | 5 |
| 15 | b | 8 |
| 25 | a | 6 |

Table T2

| A | B | C |
|---|---|---|
| 10 | b | 6 |
| 25 | c | 3 |
| 10 | b | 5 |

i) $T1 \bowtie_{T1.P=T2.A} T2$
ii) $T1 \cup T2$
iii) $T1 \bowtie_{T1.P=T2.A} T2$
iv) $T1 \bowtie_{T1.P=T2.A \text{ AND } T1.R=T2.C} T2$



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Total No. of pages. 03
SIXTH SEMESTER

Roll No.....

B.TECH (MC)

END SEMESTER EXAMINATION

MAY 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). $M = (\{q_1, q_2, q_3\}, \{0,1\}, \delta, q_1, \{q_3\})$ is a nondeterministic finite automaton, where $\delta$ is given by

$$\delta(q_1,0) = \{q_2,q_3\}, \quad \delta(q_2,0) = \{q_1,q_2\}, \quad \delta(q_3,0) = \{q_2\}$$
$$\delta(q_1,1) = \{q_1\}, \quad \delta(q_2,1) = \emptyset, \quad \delta(q_3,1) = \{q_1,q_2\}$$

Construct an equivalent DFA.

(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) Construct a Moore machine equivalent to the Mealy machine M defined by 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 |

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Q2(a). State whether the statements are true or false. Give reason for the answer.

i. If a grammar $G$ has three productions $S \to aSa, S \to bSb, S \to c$ then $abcba$, $bacab \in L(G)$.

ii. $\{a^n b^n : n \geq 1\}$ is regular

iii. If $G = (V_n, \Sigma, P, S)$ and $P \neq \emptyset$, *then* $L(G) \neq \emptyset$

iv. Two grammars of different types can generate the same language.

v. If a grammar $G$ has productions $S \to aS, S \to bS, S \to a$, then $L(G)$ is the set of all strings over $\{a, b\}$ ending in $a$.

(b) Define equivalent grammars. Show that $G_1 = (\{S\}, \{a, b\}, P_1, S)$, where $P_1 = \{S \to aSb, S \to ab\}$ is equivalent to $G_2 = (\{S, A, B, C\}, \{a, b\}, P_2, S)$, where $P_2$ consists of $S \to AC$, $S \to AB, C \to SB, A \to a, B \to b$.

(c) Define context-free grammar. Construct CFG to generate the set of all strings over {0,1} containing twice as many 0's as 1's.

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

(b) State Pumping lemma for regular set. Prove that $L = \{0^i 1^i : i \geq 1\}$ is not regular.

(c) By constructing transition system, prove that $(a + b)^* = a^*(ba^*)^*$

Q4 (a) Given the grammar $S \to AB, A \to a, B \to C/b$, $C \to D, D \to E$, $E \to a$, Find an equivalent grammar which is reduced and has no unit productions.

(b) Reduce the following grammar to CNF:
$S \to S+S$, $S \to S * S$, $S \to a$, $S \to b$.

(c) Reduce the following grammar to GNF:
$S \to AB, A \to BSB, A \to BB, B \to aAb, B \to a, A \to b$.

Q5(a) Prove that if a pda $A = (Q, \Sigma, \Gamma, \delta, q_0, Z_0, F)$ accepts L by final state, then we can construct a pda B accepting L by empty store.

(b) Construct a pda A equivalent to the following CFG:
$S \to 0BB, B \to 0S / 1S / 0$. Test whether 010000 is in N(A).

(c) Consider the Turing machine M described by the transition table below. Describe the processing of (i) 011, (ii) 0011, (iii) 001 using ID's. Which of the above are accepted by M.

| Present State | | | Tape Symbol | | |
|---|---|---|---|---|---|
| | 0 | 1 | $x$ | $y$ | b |
| $\to q_1$ | $xRq_2$ | | | | $bRq_5$ |
| $q_2$ | $0Rq_2$ | $yLq_3$ | | $yRq_2$ | |
| $q_3$ | $0Lq_4$ | | $xRq_5$ | $yLq_3$ | |
| $q_4$ | $0Lq_4$ | | $xRq_1$ | | |
| $q_5$ | | | | $yRq_5$ | $bRq_6$ |
| $(q_6)$ | | | | | |

END

*Total No. of Pages: 2*
**6th Semester**
**End Semester Examination**

*Roll No.....*
**B. Tech.**
**(May-2018)**

**MC 310: Software Engineering**

**Time: 3 Hours**

**Max. Marks: 50**

**Note: Attemt any five questions. Each question carries equal marks.**

1. **(a)** What do you understand by a software life cycle model? What problems might occur if a software development organization does not use any specific life cycle model?

   **(b)** Discuss quality function deployment technique of requirements elicitation. Why an importance or value factor is associated with every requirement?

2. **(a)** Discuss the prototype model. What is the effect of designing a prototype on the overall cost of the software project?

   **(b)** What are size metrics? How is function point metric is advantageous over LOC metric?

3. Given the following, create a context-level DFD for a university library system.

The system must record the books owned by the library. The library manager will update this list of books on a regular basis. The system must record who has borrowed what books, and which books have been returned. Before someone can borrow a book, they must show a valid ID card that is checked to ensure that it is still valid against the student database maintained by the Registrar's Office (for student borrowers), the faculty/staff database maintained by the Personnel Office (for faculty/staff borrowers), or against the library's own guest database (for individuals issued a "guest" card by the library). The system must also check to ensure the borrower does not have any overdue books or unpaid fines before he or she can borrow another book. Every Monday, the library prints and mails postcards to those

people with overdue books. If a book is overdue by more than two weeks, a fine will be imposed. Sometimes books are lost or are returned in damaged condition. The manager must then remove them from the database and will sometimes impose a fine on the borrower.

**4. (a)** Explain, with an example, how an intermediate COCOMO provides more accurate estimates as compare to basic COCOMO.

**(b)** Explain with examples, top down, bottom up and hybrid approaches of software design.

**5. (a)** Define module cohesion and explain defferent types of cohesion. If a module has logical cohesion, what kind of coupling is this module likely to have with others?

**(b)** For a program with number of unique operators $\eta_1 = 30$ and number of unique operands $\eta_2 = 50$, compute the program volume, effort and time, program length and program level.

**6. (a)** Define the terms 'software reliability' and 'software quality'. How can these be measured ?

**(b)** Differentiate between alpha testing and beta testing and explain black box testing.

**7. (a)** Explain Boehm software quality model.

**(b)** Explain equivalence class testing and integration testing.

Total no. of pages :2
6th SEMESTER
END SEMESTER EXAMINATION

Roll No. _____

B.Tech ( MC- Engg.)
May 2018

# 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) The current price of silver is $Rs.5000$ per 100gm. The storage cost is $Rs.0.60$ per gm per year payable quarterly in advance. Assuming that constant interest rate of 9% compounded quarterly, calculate the forward price of silver for 1kg for delivery in 6 months.

   (b) Consider purchase of 100 units of 3-month Rs.25-strike European call option. It is given that the stock is currently selling for Rs.20; the continuous compounding risk free interest is 5%; the stocks volatility is 24% per annum. If the stock pays dividends continuously at the rate of 3% per annum, determine the price of block of 100 call options, assuming the Black-Scholes framework.

   (c) Let $X(t) = \mu t + \sigma W(t), -\infty < \mu < \infty, 0 < \sigma < \infty$. Prove that $\{X(t), t \geq 0\}$ is a martingale for $\mu = 0$.

   (d) Prove that if short sales are not allowed then the risk of the portfolio can not exceed the greater of the risks of the individual components of the portfolio.

2. (a) State and prove Put-Call parity formula.

   (b) Consider a stock whose value S(t) follows sde $dS = r.Sdt + \sigma.SdW$ and has a current price S(0). What is the probability that a call option is in the money based on a strike price $K = 1.25\,S(0)$ at time of expiration T? Given that $T = 0.5, r = 0.04$ and $\sigma = 0.10$.

- ٥٤ -

3. (a) Find the stochastic differential of $W^2(t)$.

   (b) Use the first version of Ito-Doeblin formula to evaluate $\int_0^T 3W^3(t)dW(T)$

4. (a) Let $B(0) = Rs.100, B(1) = Rs.110$ *and* $S(0) = Rs.82$.

$$S(1) = \begin{cases} Rs.95, & with\ probability\ p = 0.80 \\ Rs.70, & with\ probability\ p = 0.20. \end{cases}$$

   For K = Rs.90 and T = 1 year, determine P(0).

   (b) Derive the expression for line which converts into Capital Market line. Explain the condition of CML with respect to efficient frontier.

5. (a) Find the expression for feasible region of 'n' asset portfolio in $(\sigma, \mu)$ – plane , and describe it.

   (b) Suppose the portfolios are constructed using three securities a1, a2, a3 with expected returns, $\mu_1 = 20\%$, $\mu_2 = 13\%$, $\mu_3 = 4\%$ standard deviations of returns, $\sigma_1 = 25\%$, $\sigma_2 = 28\%$, $\sigma_3 = 20\%$, and the correlation between returns, $\rho_{12} = 0.3$, $\rho_{13} = 0.15$ and $\rho_{23} = 0.4$ . What are the weights of the three securities in this portfolio with minimum risk, While desired expected return is 20%.

Total No. of pages. 03 Roll No.....

SIXTH SEMESTER B.TECH(MC) (OLD SCHEME)

END SEMESTER EXAMINATION MAY 2018

MC- 314 THEORY OF COMPUTATION

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 NDFA. Prove that for every NDFA, there exists a DFA which simulates the behaviour of NDFA.

(b) Define Mealy machine. Construct a Mealy machine which is equivalent to the Moore machine defined below:

| Present State | Next State | | Output |
|---|---|---|---|
| | a=0 | a=1 | |
| $q_0$ | $q_1$ | $q_2$ | 1 |
| $q_1$ | $q_3$ | $q_2$ | 0 |
| $q_2$ | $q_2$ | $q_1$ | 1 |
| $q_3$ | $q_0$ | $q_3$ | 1 |

(c) Write all the steps involved in constructing minimum automaton. Construct a minimum automaton equivalent to a DFA whose transition table is defined below.

| State | a | b |
|---|---|---|
| $\rightarrow q_0$ | $q_1$ | $q_2$ |
| $q_1$ | $q_4$ | $q_3$ |
| $q_2$ | $q_4$ | $q_3$ |
| $(q_3)$ | $q_5$ | $q_6$ |
| $(q_4)$ | $q_7$ | $q_6$ |
| $q_5$ | $q_3$ | $q_6$ |
| $q_6$ | $q_6$ | $q_6$ |
| $q_7$ | $q_4$ | $q_6$ |

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Q2(a) Define a Grammar and derivation in a grammar. Find the language generated by the grammar

(i) $S \to 0S1, S \to 0A1, A \to 1A, A \to 1$

(ii) $S \to 0A, S \to 1S, S \to 0, S \to 1, A \to 1A, A \to 1S, A \to 1$

(b) Define equivalent grammars. Show that $G_1 = (\{S\}, \{a, b\}, P_1, S)$, where $P_1 = \{S \to aSb, S \to ab\}$ is equivalent to $G_2 = (\{S, A, B, C\}, \{a, b\}, P_2, S)$, where $P_2$ consists of $S \to AC,\ S \to AB, C \to SB, A \to a, B \to b$.

(c) Show that the set of context-free languages is closed under concatenation and transpose operation.

Q3. (a) State and prove Pumping Lemma for regular sets. Show that

$\{w \in \{a, b\}^* : w \text{ contains an equal number of } a\text{'s and } b\text{'s}\}$ is not regular.

(b) Prove the following:

(i) $P + PQ^*Q = a^*bQ^*$, where

$P = b + aa^*b$ and $Q$ is any regular expression.

(ii) $\wedge + 1^*(011)^*(1^*(011)^*)^* = (1 + 011)^*$

(iii) If $G = (\{S, C\}, \{a, b\}, P, S)$, where $P$ consists of $S \to aCa, C \to aCa/b$ then

$$L(G) = \{a^n b a^n : n \geq 1\}$$

(c) State and prove Arden's theorem. Describe the algebraic methods using Arden's theorem to find the regular expression recognized by a transition system.

Q4 (a) Let G be the grammar $S \to 0B/1A,\ A \to 0/0S/1AA,$ $B \to 1/1S/0BB$. For the string 00110101, find the left most and the right most derivation. Also find the derivation tree.

(b) Reduce the following grammar into CNF:
$S \to aAbB, A \to aA/a, B \to bB\ /\ b.$

(c) Construct a reduced grammar equivalent to the grammar

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

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

(b) Let A= ( Q, $\Sigma, \Gamma, \delta, q_0, Z_0$,F) be a PDA. Prove that if $(q, x, \propto) \vdash^* (q', \wedge, \gamma)$ then$\forall$ $\beta \in \Gamma^*$ , $(q, x, \propto \beta) \vdash^* (q', \wedge, \gamma\beta)$ . Show by an example that converse need not be true.

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

**END**