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 (<u>resortNo</u>, resortName, resortType, resortAddress, resortCity, numSuite)

SUITE (<u>suiteNo</u>, resortNo, suitePrice)

RESERVATION (<u>reservationNo</u>, resortNo, visitorNo, checkIn, checkout, totalVisitor, suiteNo)

Visitor (<u>visitorNo</u>, firstName, lastName, visitorAddress)

P.T.O

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) $T1 \bowtie_{T1.P=T2.A \text{ AND } T1.R=T2.C} T2$

P.T.O

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

SIXTH SEMESTER 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 δ 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

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 $\sigma = 0.10$.

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 $S(0) = Rs.82$.
$S(1) = \begin{cases} Rs.95, & \text{with probability } p = 0.80 \\ Rs.70, & \text{with probability } p = 0.20. \end{cases}$
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 (σ, μ) – 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%.

OLD

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

OLD

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

$\{w \in \{a, b\}^* : w \text{ contains an equal number of } a's \text{ and } b's\}$ 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, Σ, Γ, δ, 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

Total No. of pages: 4

Roll No: _____

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.

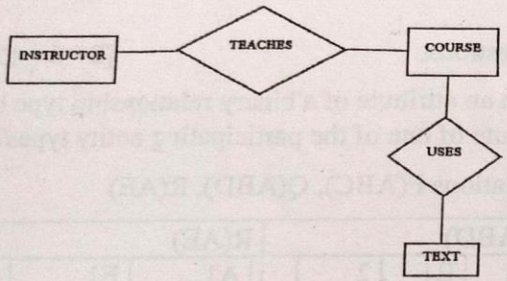
d) If a relation instance is violating an MD (multivalued dependency), then the relation can be made to satisfy the MD by possibly adding some selected tuples. State True or False. Justify.

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 store record pointers

Total No. of Pages 04 Roll No.....

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*

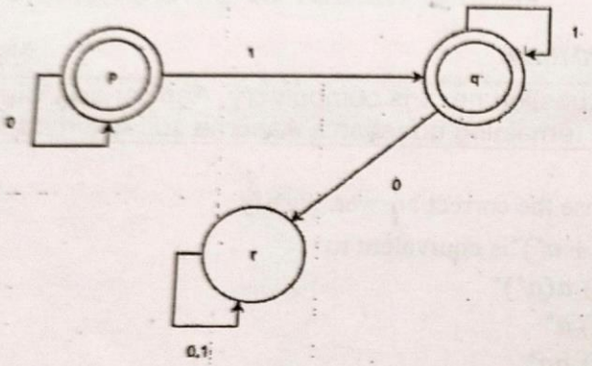
ii. In a deterministic pda, $|\delta(q, a, Z)|$ is
   a) Equal to 1
   b) Less than or equal to 1
   c) Greater than 1
   d) Greater than or equal to 1

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

v. 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)

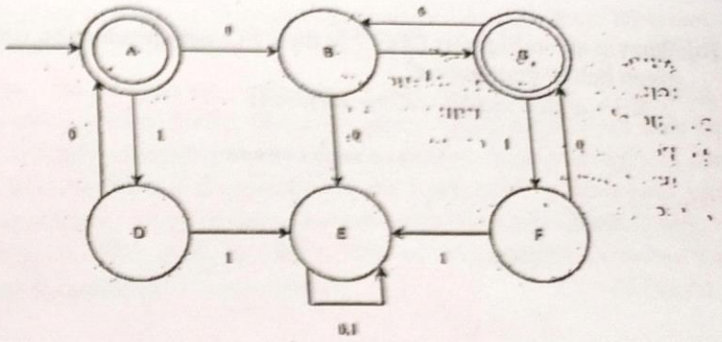
Q.3[a] Define Chomsky Classification of languages. Construct a regular grammar to generate {abc, bca, cab} with $\Sigma = \{a, b, c\}$. (5)

[b] Reduce the grammar to CNF :

$$S \rightarrow aSa|bSb|A|\Lambda \qquad A \rightarrow a|b|\Lambda$$ (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:

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

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

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

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

Total no. of pages :2 Roll No._____

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 cal option is exercised based on a strike price $K = Rs.52$ at time o 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.

Total No. of Pages: 02 Roll No:.....

SIXTH SEMESTER B. Tech.

End Semester Examination May- 2019

MC-310 Software Engineering

Time: 3 Hours Max. Marks: 50

Note: Attempt any five questions. All questions carry equal marks.

(1) (a) Explain the prototype model of software development. Mention its advantages and disadvantages. Give an example of software project that would be amenable to the prototyping model.

(b) Describe the various applications of software.

(2) (a) Discuss the importance of software requirements specification. Choose any piece of software which you use regularly. Briefly describe the requirements that the software meets for you as the user. Suggest two ways in which the software could be improved for you.

(b) What are the characteristics of a good design? Describe different types of coupling and cohesion.

(3) (a) Explain the SEI Capability Maturity Model (CMM). Why is it suggested that CMM is a better choice than ISO-9001?

(b) Describe separation of concerns. Is there a case when a 'divide and conquer' strategy may not be appropriate? How might such a case affect the argument for modularity?

(4) (a) Discuss reverse engineering and re-engineering.

(b) Consider a project to develop a full-screen editor. The major components identified are: (1) screen edit, (2) command language interpreter, (3) file input and output, (4) cursor movement, and (5) screen movement. The sizes for these are estimated to be 4K, 2K, 1K, 2K, and 3K delivered source code lines.

Use the COCOMO model to determine

(i) overall effort and schedule estimates (assume values for different cost drivers, with at least three of them being different from 1.0) and

(ii) effort and schedule estimates for different phases.

(5) (a) What is software quality? Discuss software quality attributes.

(b) Assume that a program will experience 100 failures in infinite time. It has now experienced 50. The initial failure intensity was 10 failures/CPU hr.

(i) Determine the current failure intensity.

(ii) Find the decrement of failure intensity per failure.

(iii) Calculate the failures experienced and failure intensity after 10 and 50 CPU hrs. of execution.

(iv) Compute additional failures and additional execution time required to reach the failure intensity objective of 2 failures/CPU hr.

Use the basic execution time model of software reliability for the calculations.

(6) (a) Why do we need metrics in software? Discuss the areas of applications of software metrics. State the advantages and disadvantages of using LOC as a metric.

(b) What is software maintenance? Describe various categories of maintenance. Which category consumes maximum effort and why?

(7) (a) What are the different levels of testing and the goals of the different levels? For each level, specify which of the testing approaches is most suitable.

(b) Write a brief note on current trends in Indian software industry. State three key challenges facing software engineering? Give examples (both positive and negative) that indicate the impact of software on our society.

End

Total No. of Pages 03

Roll No.....

VI SEMESTER

B.Tech.

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

Subject Code: MC 312 **Course Title: Artificial Intelligence**

Time: 3:00 Hours *Max. Marks : 40*

Note : Answer any five questions.
Question 1 is compulsory.
Assume suitable missing data, if any.

Q.1 Write short notes on any four.

a. Semantic Nets and Conceptual dependency
b. Propositional and Predicate logic
c. Monotonic and Non-monotonic reasoning
d. Dempster-Shafer theory
e. Natural language processing (NLP)
f. Crisp sets and Fuzzy sets

(3+3+3+3)

Q.2[a] A cryptarithmetic puzzle is a mathematical game where the digits of some numbers are represented by letters (or symbols). Each letter represents a unique digit. The goal is to find the digits such that a given mathematical equation is verified.

Formulate the following puzzle as a CSP:

$$\begin{array}{r} ODD \\ +ODD \\ \hline EVEN \end{array}$$

(4)

[b]

(i) Create semantics net for statement "Mouse is a Rodent and Rodent is a mammal. Mouse has teeth and etas grass".

(ii) Create a frame of the person Ram who is a doctor. He is of 40. His wife name is Sita. They have two children Babu and Gita. They live in 100 kps street in the city of Delhi in India. The zip code is 756005. (3)

Q.3 Consider the following statements for a lucky student

1. Anyone passing his history exams and winning the lottery is happy.
2. Anyone who studies or is lucky can pass all his exams.
3. John did not study but he is lucky.
4. Anyone who is lucky wins the lottery.

Convert all statements to equivalent predicate and prove that "John is happy!" using resolution for predicate. (7)

Q.4 Explain the concept of perceptron algorithm. The following table shows a data set and the number of times each point is misclassified during a run of the perceptron algorithm, starting with zero weights. What is the equation of the separating line found by the algorithm, as a function of x1, x2, and x3? Assume that the learning rate is 1 and the initial weights are all zero. Find the equation of the separating line. (3+4)

x1	x2	x3	y	times misclassified
2	3	1	+1	12
2	4	0	+1	0
3	1	1	-1	3
1	1	0	-1	6
1	2	1	-1	11

Q.5 What are the advantages of fuzzy c-means (FCM) clustering over k-means clustering algorithm? Write down the expression of membership value and cluster centroid formula for FCM. Apply k-means on the following data assuming k=2. Initial cluster centroids are (1.0, 1.0), (5.0, 7.0). Obtain the final centroids. (3 + 4)

Subject	A	B
1	1.0	1.0
2	1.5	2.0
3	3.0	4.0
4	5.0	7.0
5	3.5	5.0
6	4.5	5.0
7	3.5	4.5

Q.6 A Mars rover has to leave the lander, collect rock samples from three places (in any order) and return to the lander.

Assume that it has a navigation module that can take it directly from any place of interest to any other place of interest. So it has primitive actions go-to-lander, go-to-rock-1, go-to-rock-2, and go-to-rock-3.

We know the time it takes to traverse between each pair of special locations. Our goal is to find a sequence of actions that will perform this task in the shortest amount of time.

1. Formulate this problem as a search problem by specifying the state space, initial state, path-cost function, and goal test. Try to be sure that the state space is detailed enough to support solving the problem, but not redundant.
2. What search technique would be most appropriate, and why.
3. One possible heuristic evaluation function for a state would be the amount of time required for the robot to go back to the lander from the location of the state; this is clearly admissible. What would be a more powerful, but still admissible, heuristic for this problem? (Don't worry about whether it's consistent not.)

(3+

***** All the best*****

Total no. of Pages 03 Roll No.....

SIXTH SEMESTER B.TECH (MC)

END SEMESTER EXAMINATION MAY 2019

MC-314 THEORY OF COMPUTATION

Time: 3 Hours **Maximum Marks: 70**

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

Q1(a) 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

(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

(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

Q2 (a) Define the language generated by a grammar. If G is $S \rightarrow aS, S \rightarrow bS, S \rightarrow a, S \rightarrow b$, find $L(G)$.

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

(c) State and prove Arden's theorem. Prove that

$P + PQ^*Q = a^*bQ^*$ *where* $P = b + aa^*b$ *and* Q is any regular expression.

Q3 (a) State and prove Kleene's theorem. Construct a finite automaton equivalent to the regular expression $a^*(ba^*)^*$.

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

(c) Prove that

(i) If L is regular then L^T is also regular.

(ii) If L is regular set over Σ, then $\Sigma^* - L$ is also regular over Σ.

Q4 (a) Construct a reduced grammar equivalent to the grammar

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

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

(c) Reduce the following grammar to CNF:

$S \rightarrow ASA, S \rightarrow bA, A \rightarrow B, A \rightarrow S, B \rightarrow c.$

Q5(a)Considera pda $A = (\{q_0, q_1, q_f\}, \{a, b, c\}, \{a, b, Z_0\}, \delta, q_0, Z_0, \{q_f\})$ where δ is defined as

$\delta(q_0, a, Z_0) = \{(q_0, aZ_0)\},\ \delta(q_0, b, Z_0) = \{(q_0, bZ_0)\}$

$\delta(q_0, a,\ a) = \{(q_0, aa)\},\ \delta(q_0, b,\ a) = \{(q_0, ba)\}$

$\delta(q_0, a,\ b) = \{(q_0, ab)\},\ \delta(q_0, b,\ b) = \{(q_0, bb)\}$

$\delta(q_0, c,\ a) = \{(q_1, a)\},\ \delta(q_0, c,\ b) = \{(q_1, b)\}$

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

$\delta(q_1, \Lambda,\ Z_0) = \{(q_f, Z_0)\}$

Show that the set $L = \{wcw^T : w\ \varepsilon\ \{a, b\}^*\}$ is accepted by state.

(b) Design the Turing Machine for the following languages:

(i) $L = \{a^n : n \geq 1\}$ (ii) $L = \{a^{2n} : n \geq 1\}$ (iii) $L = [(a +$

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

(v) L = set of string over {0,1} starting with 00.

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

Total No of pages: 02 Roll Number--------

B. Tech Eighth Semester

End Semester Examination May–2019,

MC-4121 Optimization Tech.

Time 3:00 Hours Maximum marks: 70

Answer any five questions, and each question has equal marks

1 (a) Define convex function and concave functions on a set $S \subset R^n$ and provide suitable examples of such functions and explain the convexity/concavity properties within the domain

(b) show the examples of the function (i) that is both convex and concave (ii) neither convex nor concave

2. (a) Let $S \subset R^n$ be convex set and $f: S \to R$, then f is a convex function on S if and only if its epigraph is convex set.

(b) Let $S \subset R^n$ be an open convex set and $f: S \to R$ is differentiable. Let f be a convex function on S, then show that for all x and $u \in S$, we have $f(x) - f(u) \geq (x-u)^T \nabla f(u)$

3. (a) write short notes on convex programming problem and its necessity and sufficiency conditions for obtaining local max or local min points of the objective function.

(b) use method of Lagrange multipliers to solve

$$\min \frac{x^3}{3} - \frac{3y^2}{2} + 2x$$

$$subject\ to\ (x-y) = 0$$

4. Use Wolfe's method to solve the following quadratic programming problem

$$Max \quad z = x_1 + x_2 - x_1^2 + 2x_1x_2 - 2x_2^2$$

$$Subject\ to\ 2x_1 + x_2 \leq 1$$

$$x_1, x_2 \geq 0$$

P.T.O

5. State Barrier function method to solve the constrained nonlinear program. Use analytical implementation of the barrier function method to solve

$$Min \quad x^2$$
$$subject\ to \quad -1 \leq x \leq 1$$

6, (a) Describe Karush Kuhn Tucker necessary sufficient conditions for solving a constrained nonlinear program

(b) Illustrate the formulation and application of Karush Kuhn Tucker conditions to solve the following nonlinear programming problem

$$\max f(x) = \ln(x_1 + 1) + x_2$$
$$subject\ to\ 2x_1 + x_2 \leq 3$$
$$x_1 \geq 0, x_2 \geq 0$$

-End-

SIXTH SEMESTER B.Tech.

SUPPLEMENTARY EXAMINATION **SEP-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. $a^*(a+b)^*$ 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 , $\delta(q, a), q \varepsilon Q, a \varepsilon \Gamma$ is
   a) defined for all $(q, a) \varepsilon Q \times \Gamma$
   b) defined for some, not necessarily for all $(q, a) \varepsilon Q \times \Gamma$
   c) defined for no element $(q, a) \varepsilon Q \times \Gamma$
   d) a set of triples with more than one element

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

v. State True or False with justification.

a) Two grammars of different types can generate the same language.

b) A regular language is context-free.

Q.2 [a] State and prove Kleene's Theorem for regular expressions. (5)

[b] Construct a DFA accepting all strings over $\{a,b\}$ ending in ab. (5)

Q.3[a] Design a Turing machine to recognize all strings consisting of an even number of 1's. (5)

[b] Find an equivalent grammar which is reduced and has no unit productions: (5)

$S \to AB,\ A \to a,\ B \to C|b,\ C \to D,\ D \to E,\ E \to a$

Q.4[a] State and prove Pumping Lemma for regular sets. Is $\{a^{i^2} \mid i \geq 1\}$ regular. (5)

[b] Minimize the automata : (5)

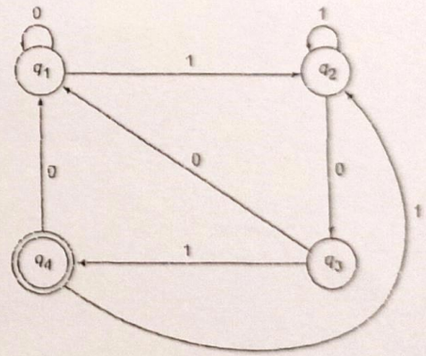
State	Input	
	a	b
$\to q_0$	q_0	q_3
q_1	q_2	q_5
q_2	q_3	q_4
q_3	q_0	q_5
q_4	q_0	q_6
q_5	q_1	q_4
q_6	q_1	q_3

Q.5 [a] 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)

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

Present State	Next State		Output
	a= 0	a= 1	
$\to q_0$	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

Q.6 [a] Find the regular expression corresponding to the state diagram given below, if q_1 is the only initial state. (5)



[b] What is an ambiguous CFG? Show that the grammar $S \to SbS|a$ is ambiguous? (5)

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

Roll No._____

B.Tech (MC- Engg.)
Sep 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) The current price of gold is Rs.25000 per 10 gm. The storage cost is Rs.200 per gm per year payable quarterly in advance. Assuming that constant interest rate of 9% compounded quarterly, calculate the forward price of gold for delivery in nine months.

   (b) The current stock price is Rs. 225. A six month call option on this stock with strike price Rs. 245 is priced using Black-Scholes formula. It is given that continuously compounded risk free rate is 6%, stock pays no dividend and the volatility of the stock is 18%. Determine the price of call and put options.

   (c) Let $\{N(t), t \geq 0\}$ be a Poisson process with parameter λ. Prove that $\{N(t);\ \lambda > 0\}$ is not a martingale.

   (d) Consider a portfolio of two assets. a1 & a2 with no short sell, with the following statistical parameters $\mu 1 = 5\%$, $\mu 2 = 10\%$, $\sigma 1 = 10\%$, $\sigma 2 = 40\%$, $\rho 12 = -0.05$. Find the value of minimum risk, the expected return and weight of the assets.

2. (a) Find the stochastic differential equation of $Cos(W(t))$ using Ito – Doeblin formula of version two.

   (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 $T = 9$ months, $r = 0.04$ and $\sigma = 0.20$.

3. (a) Let $S(0) = \$50$, $r = 5\%$, $u = 0.3$ and $d = -0.1$. Find the price of a European call and put with strike price $X = \$60$ to be exercised after $N = 2$ time steps, using CRR- formula.

   (b) Find the SDE of $W^2(t)$ using Ito-Doeblin formula of version two.

4. (a) State and prove the Put – Call parity formula for European call and put option, with current price of stock S(0) and exercise price X and exercise time T.

   (b) Let $\{S_n, n=0,1,2,\ldots.\}$ 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.

5. (a) For two asset portfolio prove that the variance of the portfolio can no exceed the greater of the variances σ_1^2 & σ_2^2 of the component assets, if there is no short sell.

   (b) Using the following data:

Scenario	Probability	Return $K1$	Return $K2$
$\omega 1$ (recession)	0.4	−10%	20%
$\omega 2$ (stagnation)	0.2	0%	20%
$\omega 3$ (boom)	0.4	20%	10%

   Find the weights in a portfolio with expected return $\mu_V = 26\%$ and compute the risk of this portfolio

Total No. of Pages: 02

SIXTH SEMESTER
Supplementary Examination

Roll No:.....

B. Tech.
September-2019

MC-310 SOFTWARE ENGINEERING

Time: 3 Hours

Max. Marks: 50

*Note: Attempt **any five** questions. All questions carry equal marks.*

(1) (a) Discuss the major characteristics and areas of applications of a software.
(b) Describe the spiral model of software development. Explain how both waterfall model and prototyping model can be accommodated in the spiral model.

(2) (a) What is DFD? Choose a transaction that you are likely to encounter, perhaps ordering a suit for graduation, and develop a high-level DFD. Decompose this to a level-0 diagram.
(b) What are the characteristics of a good design? Describe different types of coupling and cohesion.

(3) (a) Explain all the levels of COCOMO model. Assume that the size of an organic software product has been estimated to be 32,000 lines of code. Determine the effort required to develop the software product and the nominal development time.
(b) What are functional and non-functional requirements? Describe the various steps of requirements engineering process.

(4) (a) Explain the steps involved in project planning. Discuss the various factors that affect a project plan.
(b) What is risk? Mention various risks that can be incurred in a software development project. Discuss how you would manage those risks at different phases.

(5) (a) What is software reliability? Describe the Jelinski-Moranda model of reliability.
(b) Assume that the initial failure intensity is 20 failures/CPU hr. The failure intensity decay parameter is 0.02/failure. We have experienced 100 failures up to this time.
(i) Determine the current failure intensity.
(ii) Find the decrement of failure intensity per failure.
(iii) Calculate the failures experienced and failure intensity after 20 and 100 CPU hrs. of execution.
(iv) Compute additional failures and additional execution time required to reach the failure intensity objective of 2 failures/CPU hr.

Use Logarithmic Poisson execution time model of software reliability for the calculations.

(6) (a) Why do we need metrics in software? Discuss the areas of applications of software metrics. State the advantages and disadvantages of using LOC as a metric.

(b) What is software maintenance? Explain why a software system that is used in a real-world environment must change or become progressively less useful.

(7) (a) What are the objectives of testing? Explain why testing can only detect the presence of errors, not their absence.

(b) Identify three major challenges that software engineering is likely to face in the next 10 years. Explain how the universal use of the Web has changed software systems.

End