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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FIFTH SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2017

Course Code: CS367

Course Name: LOGIC FOR COMPUTER SCIENCE (CS)

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks. Marks

1 Draw formation tree and construct truth tables for (3)

$(a \rightarrow (b \rightarrow c)) \rightarrow ((a \rightarrow b) \rightarrow (a \rightarrow c))$

2 a) Prove $P \rightarrow Q \equiv \neg (P \wedge \neg Q)$ *using truth table.* (1.5)

b) Prove $P \rightarrow Q \models (\neg P \rightarrow \neg Q)$ *using truth table.* (1.5)

3 Prove $(a \vee b) \rightarrow (b \vee a)$ in Gentzen system. (3)

4 Prove $\neg P \rightarrow (P \rightarrow Q)$ in Hilbert system. (3)

PART B

Answer any two full questions, each carries 9 marks.

5 a) What are the steps for constructing semantic tableau in Propositional logic. (4)

b) Check the satisfiability of the formula $F = (a \vee b) \wedge (\neg a \wedge \neg b)$ using semantic tableaux and truth table. (5)

6 a) Using Structural Induction, show that a property holds for all formulas (4)

$A \in F$:Prove that the property holds all atoms p. Assume that the property holds for a formula A and prove that the property holds for $\neg A$.

b) Construct a derivation tree for the formula $a \rightarrow b \leftrightarrow \neg a \rightarrow \neg b$ *using the production rules:* (5)

$fml ::= a \mid b$ For any $a \in A$

$fml ::= \neg fml$

$fml ::= fml\ op\ fml$

$op ::= \vee \mid \wedge \mid \rightarrow \mid \leftrightarrow \mid \oplus \mid \uparrow \mid \downarrow$

7 Transform the set of formulas $\{p,\ p \rightarrow ((q \vee r) \wedge \neg (q \wedge r)),\ p \rightarrow ((s \vee t) \wedge \neg (s \wedge t)),\ s \rightarrow q,\ \neg r \rightarrow t,\ t \rightarrow s\}$ in clausal form and refute using resolution. (9)

PART C

Answer all questions, each carries 3 marks.

8 a) Construct the tree representation for the formula $\forall x(\neg\exists y p(x, y) \vee \neg\exists y p(y, x))$. (1)

b) Prove: $\models \forall x(A(x) \vee B(x)) \rightarrow \forall x A(x) \vee \exists x B(x)$. (2)

9 Construct reduced OBDD's for the formula $p \vee (q \wedge r)$ using ordering of the variables $\{(p, q), (p, q, r), (p)\}$ (3)

10 Prove $\forall x A(x) \rightarrow \exists x A(x)$ in Hilbert System. (3)

11 What are the axioms used in Hilbert System of first order logic. (3)

PART D

Answer any two full questions, each carries 9 marks.

12 Construct the semantic tableau for the formula (9)

$\forall x(p(x) \vee q(x)) \rightarrow (\forall x p(x) \vee \forall x q(x))$ and check whether it is satisfiable or not.

13 Transform the formula into clausal form using Skolem's Algorithm: (9)
$\forall x(p(x) \rightarrow q(x)) \rightarrow (\forall x p(x) \rightarrow \forall x q(x))$.

14 Unify the following equation g(y)=x,f(x,h(x),y)=f(g(z),w,z) with the help of unification algorithm. (9)

PART E

Answer any four full questions, each carries 10 marks.

15 a) What are the tableau rules of Linear Temporal Logic (4)

b) Check the satisfiability of the formula: (3)

$A = (p \vee q) \wedge O(\neg p \wedge \neg q)$ using tableau rules.

c) Prove $\vdash \Box\Box p \leftrightarrow \Box p$ (3)

16 Prove $O(p \wedge q) \leftrightarrow (O p \wedge O q)$. (10)

17 a) Prove $\models p(x=x0)y := x(y=y0)$ (5)

b) Prove $\models p(x=y)\ x := x+1; y := y+1(x=y)$ (5)

18 a) What are the issues of program correctness? (4)

b) How the Hoare triples are represented?Define its syntax and semantics. (3)

c) What are the different types of statements used in CL language. (3)

19 a) What are the formulation rules of modal propositions. (4)

b) Construct parse tree for the formula $\Diamond(\Box(p \leftrightarrow \neg q) \wedge \Diamond(q \rightarrow p) \vee \neg q)$ (2)

c) Prove $\models \Box(p \wedge q) \rightarrow (\Box p \wedge \Box q)$ using modal logics. (4)

20 a) Define axiomatic system in KC and mention the axiom schemes in KC. (4)

b) Prove $p \wedge O\Box\ p \rightarrow \Box p$ (Contraction) in Temporal logic. (6)

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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
THIRD SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2017

Course Code: CS361

Course Name: SOFT COMPUTING (CS)

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks. Marks

1 Explain the different learning mechanisms used in Artificial Neural Networks with the help of necessary diagrams. (3)

2 With the help of an example, state the role of bias in determining the net output of an Artificial Neural Network. (3)

3 Illustrate the different steps involved in the training algorithm of Perceptrons. (3)

4 State the concept of delta-rule used in Adaptive Linear Neurons. (3)

PART B

Answer any two full questions, each carries 9 marks.

5 Design a Hebb network to realize logical OR function. (9)

6 Implement AND logical function using Perceptrons. (9)

7 a) How is the training algorithm performed in back-propagation neural networks? (5)

b) With graphical representations, explain the activation functions used in Artificial Neural Networks. (4)

PART C

Answer all questions, each carries 3 marks.

8 List and explain the various operations that can be performed in fuzzy relations. (3)

9 Law of contradiction and law of excluded middle cannot be applied to fuzzy sets. Give proper justification to the statement. (3)

10 With the help of a figure, explain the features of fuzzy membership functions. (3)

11 How can the role of lambda-cuts in defuzzification be justified? Give examples. (3)

PART D

Answer any two full questions, each carries 9 marks.

12 a) Given two fuzzy sets, $M_{\sim}$ and $N_{\sim}$, such that $M_{\sim} = \left\{\frac{0}{x1} + \frac{0.8}{x2} + \frac{1}{x3} + \frac{0.8}{x4} + \frac{0}{x5}\right\}$ and $N_{\sim} = \left\{\frac{0}{y1} + \frac{0.2}{y2} + \frac{0.7}{y3} + \frac{1}{y4} + \frac{0.7}{y5} + \frac{0.2}{y6} + \frac{0}{y7}\right\}$. Construct a relation $R_{\sim} = M_{\sim} \times N_{\sim}$. (4)

b) Introduce another fuzzy set $M_{1\sim} = \left\{\frac{0}{x1} + \frac{0.8}{x2} + \frac{1}{x3} + \frac{0.6}{x4} + \frac{0}{x5}\right\}$. Find $M_{1\sim} \circ R_{\sim}$ using max-min composition. (5)

13 a) Consider the following two fuzzy sets: (4)

$$A_{\sim} = \left\{\frac{0.2}{1} + \frac{0.3}{2} + \frac{0.4}{3} + \frac{0.5}{4}\right\}$$

$B_{\sim} = \left\{\frac{0.1}{1} + \frac{0.2}{2} + \frac{0.2}{3} + \frac{1}{4}\right\}$

Find the algebraic sum, algebraic product, bounded sum, and bounded difference of the given sets.

b) Using inference method, find the membership values of the triangular shapes; isosceles (I), right angled (R), isosceles and right angled (IR), equilateral (E), and other triangles (T); for a triangle with angles 60, 55, and 65. (5)

14 a) Consider the following fuzzy relation, $R_{\sim} = \begin{bmatrix} 1 & 0.8 & 0 & 0.1 & 0.2 \\ 0.8 & 1 & 0.4 & 0 & 0.9 \\ 0 & 0.4 & 1 & 0 & 0 \\ 0.1 & 0 & 0 & 1 & 0.5 \\ 0.2 & 0.9 & 0 & 0.5 & 1 \end{bmatrix}$ (4.5)

Show that the above relation is a tolerance relation.

b) Also, show that the λ-cut relation of the above relation results in a crisp tolerance relation. (4.5)

PART E

Answer any four full questions, each carries 10 marks.

15 a) "A compound rule may be decomposed and reduced into a number of simple canonical rule forms". Explain the different methods to do so. (6)

b) How can one perform the aggregation of fuzzy rules? (4)

16 With the help of necessary block diagrams, compare Mamdani and Sugeno Fuzzy Inference Systems. (10)

17 a) With the help of examples, explain the various fuzzy propositions. (6)

b) Explain the different methods for fuzzy approximate reasoning. (4)

18 a) Explain the different methods of encoding that are possible in genetic algorithm. (6)

b) "Termination criterion for a genetic algorithm brings the search to a halt". Explain the various termination techniques. (4)

19 With the help of examples, explain the various crossover techniques employed in genetic algorithms. (10)

20 a) Illustrate the different steps in genetic-neuro hybrid systems with the help of a neat block diagram. (6)

b) Distinguish between the processes of tuning and learning in genetic-fuzzy rule based systems. (4)

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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIFTH SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2017

Course Code: CS309

Course Name: GRAPH THEORY AND COMBINATORICS (CS)

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries3 marks. Marks

1 Consider a graph G with 4 vertices: v1, v2, v3 and v4 and the degrees of vertices are 3, 5, 2 and 1 respectively. Is it possible to construct such a graph G? If not, why? (3)

2 Draw a disconnected simple graph G1 with 10 vertices and 4 components and also calculate the maximum number of edges possible in G1. (3)

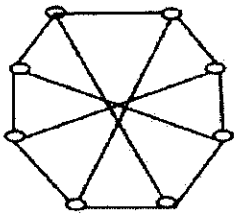
3 State Dirac's theorem for hamiltonicity and why it is not a necessary condition for a simple graph to have a Hamiltonian circuit. (3)

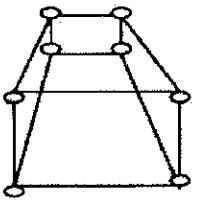
4 Differentiate between symmetric and asymmetric digraphs with examples and draw a complete symmetric digraph of four vertices. (3)

PART B

Answer any two full questions, each carries 9 marks.

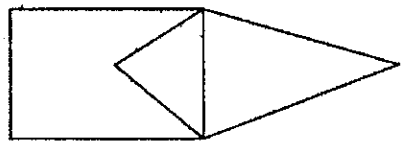
5 a) What are the basic conditions to be satisfied for two graphs to be isomorphic? Are the two graphs below isomorphic? Explain with valid reasons (6)





b) Write any two applications of graphs with sufficient explanation (3)

6 a) Consider the graph G given below: (4)



Define Euler graph. Is G an Euler? If yes, write an Euler line from G.

b) What is the necessary and sufficient condition for a graph to be Euler? And also prove it. (5)

7 a) Define Hamiltonian circuits and paths with examples. Find out the number of edge-disjoint Hamiltonian circuits possible in a complete graph with five vertices (5)

b) State Travelling-Salesman Problem and how *TSP* solution is related with Hamiltonian Circuits? (4)

PART C

Answer all questions, each carries 3 marks.

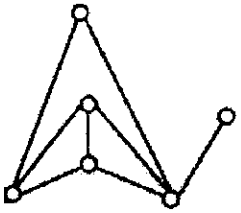
8 List down any two properties of trees and also prove the theorem: *A graph is a tree if and only if it is a minimally connected.* (3)

PART E

Answer any four full questions, each carries10 marks.

15 a) List down any four properties of adjacency matrix (4)

b) Construct an adjancy matrix(X) for the following graph and also mention how the concept of edge sequences is described with X^3 *(no need to find X^3 from X)* (6)



16 a) Prove the theorem: (4)
If A(G) is an incidence matrix of a connected graph G with *n* vertices, the rank of A(G) is *n-1*

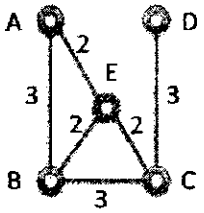
b) Describe with examples the usage of incidence matrix to find two graphs (g1 and g2) are isomorphic. (6)

17 a) Define cut-set matrix with an example and list down any four properties of cut-set matrix (6)

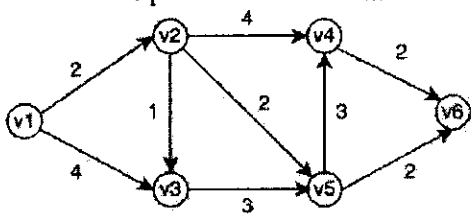
b) If B is a circuit matrix of a connected graph G with *e* edges and *n* vertices, then show that the number of linearly independent rows in B = *e-n+1* (4)

18 a) Draw the flow chart of minimum spanning-tree algorithm. (7)

b) Find MST from the graph given below by simply applying Kruskal's procedure. (3)



19 Write the Dijkstra's shortest path algorithm *(no need to draw flowchart)*. Apply this algorithm to find the shortest path between v1 and v6 (10)



20 Draw the flowchart of *Connectedness and Components* algorithm and also apply this algorithm on any graph (G) with 2 components. (10)

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FIFTH SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2017

Course Code: CS307

Course Name: DATA COMMUNICATION (CS)

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks.

1		Define simplex, half duplex and full duplex transmission mode. Give one example for each.	(3)
2		List and explain different factors which determine the performance of communication in a network?	(3)
3		Write physical and transmission characteristics of Optical Fibre Cable guided transmission media.	(3)
4		What are the advantages of microwave transmission over radio wave transmission? For a parabolic reflective antenna with a diameter of 2m, operating at 12 GHz. Calculate the antenna gain? Given effective area= 56π.	(3)

PART B

Answer any two full questions, each carries 9 marks.

5	a)	(a) Explain time domain and frequency domain concept of a signal in a communication system.	(5)
	b)	List various impairments and explain how they affect information carrying capacity of a communication link?	(4)
6	a)	How does cross talk occurs in twisted pair cables? Give the purpose of CAT5e,CAT6,CAT7 twisted pair cables.	(5)
	b)	Show that doubling the distance between transmission antenna and receiving antenna attenuates the power received by 6dB.	(4)
7	a)	Define Channel Capacity. What key factors affect highest data rate for noiseless channel and noisy channel? Signal to Noise Ratio is often given in decibels. Assume SNR_{db}=36 and the channel bandwidth is 2Mhz. Calculate theoretical channel capacity?	(5)
	b)	Explain following wireless propagation modes (i) Ground wave propagation(ii) Sky wave propagation	(4)

PART C

Answer all questions, each carries 3 marks.

8	Give the significance of delta modulation over pulse code modulation during the process of transforming analog data in to digital signal.	(3)
9	Show the equivalent analog sine-wave pattern of the bit string 00110101 using amplitude shift keying, frequency shift keying andphase shift keying	(3)
10	What are the advantages of using multiplexing in data communication?How does a synchronised time division multiplexer stay synchronized with de-multiplexer on receiving end ?	(3)
11	What type of multiplexing is preferred in optical fibre communication? Justify your answer	(3)

PART D

Answer any two full questions, each carries 9 marks.

12 a) For the bit stream 11000110010,sketch the wave form for each of the code of NRZ-I,NRZ-L, Bipolar-AMI, Pseudoternary, Manchester, Differential Manchester. (5)

b) Explain the modulation technique used in Asymmetric Digital Subscriber Line(ADSL) and cable modems (4)

13 a) With suitable example explain the working principle of Code division multiplexing for CDMA technology. (5)

b) Explain the frame format of Synchronous Optical Network(SONET) for the version SDH. (4)

14 a) State Sampling theorem. With help of suitable diagrams, explain the process of transforming analog data in to digital signal using Pulse Code Modulation technique. (5)

b) How Time division Multiplexing (TDM) handle disparity in the input data rate, if data rate of all input lines are not same? (4)

PART E

Answer any four full questions, each carries 10 marks.

15 a) Explain with suitable diagram, how asynchronous and synchronous connections are used in data communication. (5)

b) Explain major types of noise occur during data transmission, which causes errors. (5)

16 a) Why would you expect a CRC to detect more errors than a parity bit? (5)
For P=110011 and M=11100011, Find CRC.

b) With suitable examples explain sliding window error control mechanism in data communication. (5)

17 a) Give any two reasons why baseband signal cannot be directly transmitted in a wireless system? How Frequency Hopping Spread Spectrum(FHSS) spread the baseband signal for transmission. (5)

b) How does spread spectrum climinates narrow band interferences? Explain Direct Sequence Spread Spectrum(DSSS) technique. (5)

18 a) What are the different architectural components in public communication network? Explain its working principle. (5)

b) Explain the datagram approach for packet switching network. What is the significance of packet size in packet switching network? (5)

19 a) Given the dataword 1001001111 and the devisor 10111,show the generation of the CRC codeword at the sender site using binary division. (5)

b) Calculate the hamming pairwise distance among following codewords; (5)
i) 00000,10101,01010 ii) 000000,010101,101010,110110

20 a) List four major components of packet switch and write their function (5)

b) With suitable example illustrate working of virtual circuit approach for packet switching (5)

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C C7055

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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIFTH SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2017

Course Code: CS305

Course Name: MICROPROCESSORS AND MICROCONTROLLERS (IT, CS)

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks. Marks

1		List the registers used in 8086 microcontroller.	(3)
2		Describe function of the following signals of 8086. i) INTR ii) READY iii) HOLD	(3)
3		State the significance of assembler directives in an assembly language program with suitable examples?	(3)
4		Compare macro and subroutine?	(3)

PART B

Answer any two full questions, each carries 9 marks.

5		Draw and explain the internal block diagram of 8086.	(9)
6		What are the different addressing modes supported by 8086? Give explanation with suitable examples.	(9)
7	a)	Give the architectural and signal differences between 8086 and 8088?	(4)
	b)	Write an assembly language program to find the largest number from an unordered array of 8-bit numbers?	(5)

PART C

Answer all questions, each carries 3 marks.

8		Describe interrupt cycle of 8086/88 with neat diagram.	(3)
9		Give description of the following interrupts: (i) Non maskable (ii) Maskable	(3)
10		Compare I/O mapped interfacing and memory mapped interfacing.	(3)
11		Mention the salient features of basic I/O mode operation of 8255.	(3)

PART D

Answer any two full questions, each carries 9 marks.

12	a)	Interface two 4K x 8 EPROMs and two 4K x 8 RAM chips with 8086. Select suitable address maps.	(6)
	b)	Give a brief description about interrupt service routine.	(3)
13		Draw the internal architecture of 8259 and explain.	(9)
14		Describe different modes of operation of the following peripheral ICs: i) 8255 ii) 8279	(6)

PART E

Answer any four full questions, each carries 10 marks.

15	a)	What are the different types of microcontrollers?	(5)
	b)	What factors are needed to be considered for selecting a microcontroller?	(5)
16		Give brief description of memory and I/O addressing of 8051.	(10)
17		What are different addressing modes supported by 8051?	(10)
18		Draw the internal architecture of 8051 with brief description.	(10)
19		Draw and explain the internal architecture of 8254/8253.	(10)
20		Write an 8051 based assembly language program to perform addition of two 2x2 matrices.	(10)

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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FIFTH SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2017

Course Code: CS303

Course Name: SYSTEM SOFTWARE (CS)

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks. Marks

1. Explain the instruction format and addressing modes of SIC. (3)
2. Explain program relocation with an example. (3)
3. Write a sequence of instructions for SIC/XE to divide BETA by GAMMA and to store the integer quotient in ALPHA and remainder in DELTA. (3)
4. Describe the data structures used in the two pass SIC assembler algorithm. (3)

PART B

Answer any two full questions, each carries 9 marks.

5. a) What are assembler directives? List any three assembler directives in SIC machine. (4)
   b) Give the algorithm for pass 1 of a two pass SIC assembler. (5)
6. a) Describe the format of object program generated by the two-pass SIC assembler algorithm. (4)
   b) Let NUMBERS be an array of 100 words. Write a sequence of instructions for SIC to set all 100 elements of the array to 1. (5)
7. a) Write notes on the architecture of SIC/XE (4)
   b) Explain with suitable examples, how the different instruction formats and addressing modes of SIC/XE are handled during assembling. (5)

PART C

Answer all questions, each carries 3 marks.

8. Give the algorithm for an absolute loader. (3)
9. Explain the format and purpose of Define and Refer records in the object program. (3)
10. Differentiate between linking loaders and linkage editors. (3)
11. Write short notes on MASM assembler. (3)

PART D

Answer any two full questions, each carries 9 marks.

12. a) Explain the concept of single pass assembler with a suitable example. (5)
    b) Write notes on machine independent loader features. (4)
13. a) How are control sections different from program blocks? Explain, with proper examples, the purpose of EXTREF and EXTDEF assembler directives. (4)
    b) Describe the data structures used for the linking loader algorithm. Give the algorithm for pass 1 of the linking loader. (5)

14. a) Explain, with examples, the working of a multi pass assembler. (5)
    b) Write notes on the different loader design options. (4)

PART E

Answer any four full questions, each carries 10 marks.

15. a) Explain the concept of macro definition and expansion with the help of examples. (5)
    b) Write notes on the user interface of a text editor. (5)
16. a) Describe the data structures used in a one pass macro processor algorithm. (3)
    b) Give the algorithm for a one pass macro processor. (7)
17. a) Explain conditional macro expansion with an example. (5)
    b) Explain the structure of a text editor with the help of a diagram. (5)
18. a) Write notes on the debugging functions and capabilities of an interactive debugging system. (5)
    b) Differentiate between character and block device drivers. (5)
19. a) Give the general design of a device driver. (5)
    b) Explain recursive macro expansion with example. (5)
20. a) Describe any two commonly used debugging methods. (5)
    b) Write notes on keyword macro parameters, giving suitable examples. (5)

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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIFTH SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2017

Course Code: CS301

Course Name: THEORY OF COMPUTATION (CS)

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks. Marks

1 Define Non Deterministic Finite Automata? Compare its ability with Deterministic Finite Automata in accepting languages. (3)

2 Write the notations for the language accepted by DFA, NFA, ϵ-NFA (3)

3 Can we use finite state automata to evaluate 1's complement of a binary number? Design a machine to perform the same. (3)

4 Define Two-way finite automata (3)

PART B

Answer any two full questions, each carries 9 marks.

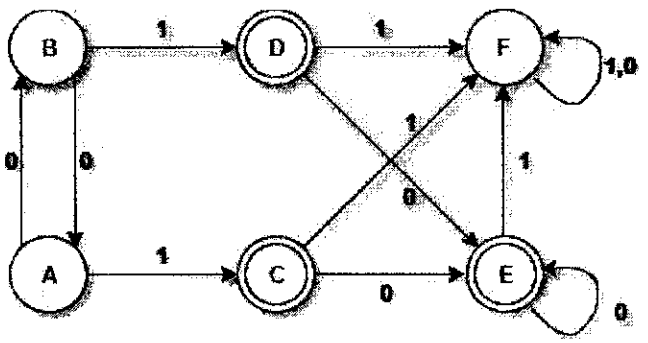
5 a) Design a Finite state automata which accepts all strings over {0,1} with odd number of 1's and even number of 0's. (5)

b) Show the changes needed to convert the above designed automata to accept even number of 1's and odd number of 0's (4)

6 a) Construct Regular grammar for the regular expression : (5)
L = (a + b)*(aa + bb)(a + b)*

b) List the closure properties of Regular sets. (4)

7 State Myhill-Nerode theorem. Minimize the following DFA by table filling method using Myhill-Nerode theorem describing the steps in detail. (9)



PART C

Answer all questions, each carries 3 marks.

8 Which Normal Form representation of CFG will you prefer in converting CFG to NPDA? Why? (3)

9 What do you mean by useless symbol in a grammar? Show the elimination of useless symbols with an example. (3)

10 Explain the different methods by which a PDA accepts a language. (3)

11 Can we construct a Deterministic PDA for the language ww^R?Justify your answer. Otherwise how can we modify this language to make it accepted by DPDA. (3)

PART D

Answer any two full questions, each carries 9 marks.

12 Define CFG for the following languages over the alphabets {a,b} (9)

i. $L = \{ a^{m+n}b^m c^n n,m>0 \}$

ii. L contains all odd length strings only

iii. $L = \{ 0^n 1^n 2^n \ n>0 \}$

13 Design a Push Down Automata for the language $L= \{a^n b^{2n} \mid n>0\}$ (9)
Trace your PDA with n=3.

14 Prove that the following languages are not regular (9)

i. $L = \{0^{i^2} such\ that\ i \geq 1\}$ is not regular

ii. $L = \{a^p\ such\ that\ p\ is\ a\ prime\ n\ umber$

PART E

Answer any four full questions, each carries 10 marks.

15 State and prove pumping lemma for Context Free Languages. (10)

16 Construct a Turing machine that recognizes the language $L = \{ a^n b^n c^n \mid n>0 \}$ (10)

17 a) What is a Context sensitive grammar(CSG). Design a CSG to accept the language $L = \{ 0^n 1^n 2^n \mid n>0 \}$ (6)

b) Define Linear Bound Automata (4)

18 a) Write a note on Recursive Enumerable Languages (5)

b) Discuss about Universal Turing Machines (5)

19 a) Explain Chomsky's Hierarchy of Languages (6)

b) Let$L = \{x/\ x \in (a + b + c)^*$ and $|x|_a = |x|_b = |x|_c \}$. What class of language does Lbelong? Why? What modification will you suggest in the grammar to accept this language? (4)

20 Discuss the Undecidable Problems About Turing Machines (10)

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