1(a) Write the method of converting an ε-NFA to a DFA by eliminating ε-transitions.

Convert the following automaton to a DFA by using the method.

<table>
<thead>
<tr>
<th></th>
<th>a</th>
<th>b</th>
<th>ε</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>φ</td>
<td>φ</td>
<td>4,2</td>
</tr>
<tr>
<td>2</td>
<td>φ</td>
<td>φ</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>φ</td>
<td>φ</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>φ</td>
<td>φ</td>
</tr>
<tr>
<td>5</td>
<td>φ</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>6</td>
<td>φ</td>
<td>φ</td>
<td>φ</td>
</tr>
<tr>
<td>7</td>
<td>φ</td>
<td>φ</td>
<td>φ</td>
</tr>
</tbody>
</table>

1(b) Design an NFA for accepting strings in \(\{0, 1\}^*\) in which fourth symbol from last is a 1.

OR

1'(a) Formally define a regular expression.

1'(b) Prove that the class of regular languages is closed under union and concatenation operations.

1'(c) State pumping lemma, and use it to prove that \(L_{pr} = \{\text{strings of 1s whose length is a prime}\}\) is not regular.

2(a) Design a PDA for the language \(\{w \mid w = xcx^R, x \text{ is in } \{0, 1\}^*\}\).
2(b) Design a CFG for accepting the language described by the regular expression \(0^*1(0+1)^*\).

2(c) Define formally each of the following:
The single step derivation, the derivation in zero or more steps, the language of a grammar, the sentential form.

3(a) Describe instantaneous description and moves made by a Turing machine, for a transition with a left move and the transition with a right move. Also discuss any special cases need to be considered.

3(b) Design a Turing machine for the language \(\{ww \mid w \text{ is any string in } \{0, 1\}^*\}\).

4(a) Describe P, NP, and NP-complete problems, giving examples of each.

4(b) Prove that it is impossible to write a program \(H\) that can test whether another program \(P\) prints "Hello, world".

4(c) Describe Post's Correspondence Problem with two examples of instances, one with a solution and one with no solution.

OR

4'(a) Explain the diagonalization problem and prove that the language \(L_d\) is not recursively enumerable.

4'(b) Explain the coding for Turing machines and strings. Show the code for the TM described by:

\[\delta(q_1, 1) = (q_3, 0, R)\]
\[\delta(q_3, 0) = (q_1, 1, R)\]
\[\delta(q_3, B) = (q_3, 1, L)\]

4'(c) Briefly explain what you mean by universal language and the universal TM.
2013-14
B.TECH. (WINTER SEMESTER) EXAMINATION
COMPUTER ENGINEERING
DATABASE MANAGEMENT SYSTEM
CO-312/304
Maximum Marks: 60
Credits: 04/05
Duration: Three Hours

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q.No Question MM

1 Attempt any two parts.
(a) What is extendible hashing? Why extendible hashing technique is preferred for database files over static hashing? Insert the following data into a file which is maintained using extendible hashing, with a bucket size equal to 3. (show intermediate steps)

\[ 4, 7, 2, 13, 8, 14, 1, 10 \]

(b) What is three-schema ANSI/SPARC database architecture? With the help of it, explain the differences between conceptual, logical and physical database design.

(c) Explain the differences between primary, secondary and clustering indexes using suitable examples? What type of indexes could be created on each attribute of following table:

Supplier(s#, sname, status, city)

Assume table is stored sorted according to the values of sname attribute. Also assume that supplier names are not unique.

2 Attempt any two parts.
(a) Explain all types of Join operations using suitable SQL statements. Give an example of how information can be lost when joining two relations having null values in the joined columns and suggest a solution.

(b) Explain all the clauses of SQL SELECT statement. What is co-related nested query? Explain it using a suitable example which also includes EXISTS.

(c) What is integrity of database? Explain the categorization of integrity rules using suitable example for each integrity category.

contd...
3 Attempt any two parts.

(a) What is the problem that leads to the development of fourth normal form? How could a relation be converted into 4NF relations? Explain using a suitable example. Relation $R(A,B,C,D,E)$ satisfies following functional dependencies:

$$B \to E, AB \to C, C \to AD$$

Decompose it into fourth normal form relations.

(b) Explain in detail what measures are taken by recovery manager to recover the database from a soft crash. What is the importance of write-ahead log rule?

(c) How the concept of Serializability is related to concurrency control in databases? Give an example schedule that is not serializable. Explain why your schedule is not serializable. Show that two phase locking protocol disallows this schedule.

4 Attempt any two parts.

(a) Write and explain any three methods to implement natural join operation. Also find the cost formulae for each of the method. Assume suitable data.

(b) Explain how the choice of distributed query processing strategy can have a significant effect on the query response time in a distributed database system. Use an example to illustrate your explanation.

(c) What are association rules? Explain the Apriori algorithm for finding association rules in a transaction database.
Question

1(a) Give a detailed comparison between the TCP/IP model and the OSI model. [08]

OR

1(a') What Ethernet interfaces are available for UTP, STP, Co-axial cable and OFC? Explain the different Ethernet technologies 1Base5, 10Base2, 10Base5, 10Broad36, 10BaseT, 10BaseFL, 10BaseFB, 100BaseT, 100BaseTX, 100BaseT4, 100BaseT2, 100BaseFX, 1000BaseT, 1000BaseSX, 1000BaseLX, 1000BaseCX, 10GBaseSR, 10GBaseLX4, 10GBaseLR, 10GBaseER, 10GBase-SW, 10GBase-LW, 10GBase-EW, 10GBaseT, 40GEthernet and 100GEthernet [08]

1(b) Differentiate between a LAN, WAN, MAN, SAN, PAN and IIAN. Support your answer with suitable diagrams. [07]

2(a) What is the difference between circuit switching and packet switching? Support your answer with suitable diagrams and examples. [08]

OR

2(a') What are the different error correction and detection techniques? Explain in detail the two-dimensional parity-check code. [08]

2(b) What is the difference between a Hub, a Switch and a Router? Explain in detail with the help of examples. [07]
3(a) Explain the different queuing techniques viz, FIFO, priority queuing and weighted fair queuing (WFQ) used to improve QoS.

OR

3(a') Explain in detail the 3-way handshake for connection establishment and connection termination in TCP networks.

3(b) Consider the network 200.10.64.0/17. Subnet it to corresponding /20 networks. Choose the second /20 network, and create a LAN with the help of this subnet and implement IP addresses on 8 PCs' of this LAN. Draw the network diagram.

4(a) Write a note on cellular internet access. What do the terms GPRS, EDGE, UMTS, HSDPA, HSUPA, HSPA and LTE stand for?

(OR)

4(a') With the help of suitable diagrams explain the GSM 2G mobile technology.

4(b) Explain in detail the functioning of SMTP protocol. How is email retrieved from the internet and displayed on your system. What are MX entries on the nameserver.
Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q.No.  Question                                                                   M.M.
1(a)   Prove that if \( f(n) = O(g(n)) \), and \( g(n) = O(f(n)) \), then \( f(n) = \theta(g(n)) \). [05]

OR

1(a')  Show that \( \log n! = O(n \log n) \). [05]

1(b)   Compute the asymptotic complexity of an algorithm with runtime \( T(n, n) \) where:
\[
T(x, k) = \theta(x) \quad \text{for } k \leq 2
\]
\[
T(k, y) = \theta(y) \quad \text{for } k \leq 2 \text{ and}
\]
\[
T(x, y) = T\left(\frac{x}{2}, \frac{y}{2}\right) + \theta(x + y).
\]

1(c)   Use a recursion tree to determine a good asymptotic lower bound on the recurrence:
\[
T(n) = T\left(\frac{n}{2}\right) + T\left(\frac{2n}{3}\right) + cn, \text{ where } c > 0 \text{ is a constant.} [05]
\]

2(a)   You are given \( n \) distinct numbers and an integer \( k > 1 \) with \( n \) divisible by \( k \). Using only comparisons, you want to partition the numbers into \( k \) equally sized disjoint sets \( S_1, S_2, \ldots, S_k \) such that for any \( i < j \) and any \( s_i \in S_i, s_j \in S_j \), you are guaranteed \( s_i < s_j \). Devise an algorithm running \( \theta(n \log k) \) time that partition the numbers as desired. You may assume \( k \) is a power of 2. [05]

2(b)   Discuss the elements of dynamic programming in the context of Longest-Common-Subsequence (LCS) problem. [05]

2(c)   Briefly compare dynamic programming with greedy method using suitable example. [05]

OR

2'(a)  Show that the worst-case running time of heapsort is \( \Omega(n \log n) \). [05]

2'(b)  Find an optimal parenthesization of a matrix-chain product whose sequence of dimensions is \(< 5, 10, 15, 8, 3 >\). [05]

2'(c)  Give a dynamic programming solution to the 0-1 knapsack problem that runs in \( O(nW) \) time, where \( n \) is number of items and \( W \) is the maximum weight of items that the thief can put in his knapsack. [05]
3(a) Briefly compare the Kruskal's and Prim's algorithms for minimum-spanning-tree in terms of computing their running times. [05]

3(b) Explain the working of Bellman-Ford algorithm of single source shortest paths for a weighted (negative & positive weights), directed graph using suitable example. [05]

3(b') Find shortest paths from a source vertex $s$ to all other vertices for a weighted, directed graph, which is shown below, using Dijkstra's shortest path algorithm. Show all intermediate steps and running time of the algorithm.

\[ \text{Graph Image} \]

3(c) Find the maximum flow from the source $s$ to the sink $t$ in a flow network, which is shown below, using Ford-Fulkerson max-flow algorithm. Show all intermediate steps and running time of the algorithm.

\[ \text{Graph Image} \]

4(a) What is meant by $P$, $NP$, $NPC$, $EXP$, and $R$ classes of problems? [05]

4(b) Write all essential steps for proving that a problem is NP-hard, and, is NP-complete. [05]

4(c) What is the clique problem? Prove that any instance of Satisfiability of Boolean formulas in 3-Conjunctive Normal Form (3-CNF-SAT) can be reduced in polynomial time to an instance of clique problem. [05]

OR

4(c') Define the travelling salesman problem. Prove that travelling salesman problem is NP-complete problem. [05]
2013-14
B.TECH. (WINTER SEMESTER) EXAMINATION
COMPUTER ENGINEERING
COMPUTER GRAPHICS
CO-315

Maximum Marks: 60  Credits: 04  Duration: Three Hours

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q.No.  Question  M.M.
1(a). With the help of a diagram, explain the functioning of an interactive graphics [06]
system. Will a graphics package be considered to be a part of this system? If no, why?

1(b). Why is programming with GLUT termed as event driven? Has it got anything to do [06]
with the GLUT API being a state machine? If yes, justify

2. Derive the decision parameter \(p_k\) and the initial condition \(p_0\) for the Bresenham's [12]
line algorithm for lines with \(|m|<1\). Use the algorithm to find \(p_k\) and the
corresponding intermediate pixel values, given endpoints (10,10) and (20,18).

OR

2'(a). Explain the data structures used within the Scan-Line Polygon Fill algorithm. For [06]
the polygon given in Fig.1, what would be the edge table (ET) and the active edge
list (AEL) entries for scan line S?

![Scan Line S Diagram](image)

Fig.1
2'(b) Explain antialiasing. Differentiate between pre-filtering and post-filtering antialiasing techniques.

3(a). Derive the composite matrix representation for general scaling by a factor $S_x$ and $S_y$ along any direction $u$ and $v$ about a fixed point $(x_f, y_f)$. Clearly indicate the matrices for individual transformations.

3(b). Derive the transformation matrix for reflection about a line $y = mx + b$ using the basic transformation functions.

4(a). Consider a view window, the contents of which are to be mapped onto a viewport as shown in Fig.2. Derive the viewing transformation matrix and use it to map the endpoints of the given line.

![Diagram showing view window and viewport](image)

Fig.2

4(b). Derive the transformation matrix for oblique projection of a 3-D object onto the view plane. Can the same matrix be utilised to perform orthographic projection? If yes, how?

OR

4'(a). How are the viewing coordinates derived from world coordinates when generating a 2-D scene from a 3-D worldview? Clearly differentiate between view reference point and “look-at” point.

4'(b). Apply the Liang-Barsky line-clipping algorithm on the line shown in Fig.3. Calculate the parametric value $u$ at the intersections with the clipping window and use it to obtain the endpoint coordinate values of the clipped line.
5(a). Consider a flat polygon represented as $Ax + By + Cz + D = 0$ used to render a surface. Explain the procedure applied on the above representation in order to obtain the spatial orientation of the polygon face and to determine its outside face.

5(b). What is Lambert's Cosine Law? Explain how is it used to obtain the illumination model for diffuse reflection off a surface illuminated by a point light source. Does the optical property of the surface have an effect on diffuse reflection?

OR

5'(a). Write the general representation of a blending function for a Bézier curve and apply it to a curve having 5 control points. Calculate the values of the blending function at each control point and use it to obtain the parametric representation of the curve.

5'(b). Write the depth-buffer algorithm for visible surface detection. How is the coherence property exploited within the algorithm in order to successively calculate the value of $z$ (depth)?
B.TECH. (WINTER END SEMESTER) EXAMINATION  
ECONOMICS AND MANAGEMENT  
ME 340/240

Maximum Marks: 60  
Credits: 04  
Duration: Three Hour

Answer all the questions.
Notations used have their usual meaning.
Assume suitable data if missing

<table>
<thead>
<tr>
<th>Q No.</th>
<th>Question</th>
<th>M.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1(a)</td>
<td>A new piece of materials handling equipment costs Rs. 20,000 and is expected to save Rs. 7500 the first year of operation. Maintenance and operating cost increases are expected to reduce the net saving by Rs. 500 per year for each additional year of operation until the equipment is worn out at the end of 8 years. Determine the net present worth of the equipment at an interest rate of 12 percent.</td>
<td>[5]</td>
</tr>
<tr>
<td>1(b)</td>
<td>A 50-kilowatt gas turbine has an investment cost of $40,000. It costs another $14,000 for shipping, insurance, site preparation, fuel lines and fuel storage tanks. The operation and maintenance expense for this turbine is $450 per year. Additionally, the hourly fuel expense for running the turbine is $7.50 per hour, and the turbine is expected to operate 3,000 hours each year. The cost of dismantling and disposing of the turbine at the end of 8 year life is $8000. If the interest rate is 15% per year, what is the annual equivalent life cycle cost of the gas turbine?</td>
<td>[5]</td>
</tr>
<tr>
<td>1(c)</td>
<td>State the law of supply and demand?</td>
<td>[2]</td>
</tr>
<tr>
<td>OR</td>
<td></td>
<td></td>
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<tr>
<td>1'(a)</td>
<td>Assets A₁ and A₂ have the capability of satisfactorily performing a required function. Asset A₂ has an initial cost of $3200 and an expected salvage value of $400 at the end of its 5 year service life. Asset A₁ costs $900 less initially, with an economic life of 10 years, has no salvage value, and its annual operating cost exceed those of A₂ by $250. When the required rate of return is 15%, state which alternative is preferred when comparison is by present worth method</td>
<td>[7]</td>
</tr>
<tr>
<td>1'(b)</td>
<td>Differentiate between GDP and GNP.</td>
<td>[2]</td>
</tr>
<tr>
<td>1'(c)</td>
<td>Explain Elasticity of demand, by giving suitable examples.</td>
<td>[3]</td>
</tr>
<tr>
<td>2(a)</td>
<td>At the end of one-half of its expected economic life, a 4-year old machine has a book value of $5800 from its original cost of $9200. Estimated operating costs for next year will amount to $6000. An equipment dealer will allow $3600 if the machine is traded in now and $2800 if it is traded in 1 year later. The dealer proposes the purchase of a new machine to perform the same function; it will cost</td>
<td>[6]</td>
</tr>
</tbody>
</table>
$14,000 installed. This machine will have an estimated operating cost of $4500 per year and a salvage value of $3000 at the end of 4 years. Is it profitable to replace the existing machine now if the minimum return on investments is 15% before taxes?

2(b) A materials testing machine was purchased for $20,000 and was to be used for 8 years with an expected salvage value of $2000. Calculate depreciation charge for year 4 and book value at end of year 3 by using double declining balance method.

2(c) What are the causes and consequences of inflation?

3(a) Is there any difference between managerial roles and managerial skills? Giving suitable examples, explain various managerial skills.

OR

3(a') What are the four basic activities of management? Explain using suitable examples.

3(b) What are the three areas of ethics which may be of special concern for managers?

OR

3(b') What are the arguments for and against social responsibility?

3(c) Discuss the role of information in a manager’s job. What are the various characteristics of useful information?

OR

3(c') Explain the differences between three common methods of group decision making: interacting groups, Delphi groups and Nominal groups.

4(a) What do you understand by organizational planning? Differentiate among strategic, tactical and operational plans.

4(b) What is the difference between chain of command and span of control?

4(c) How is the leadership different from management? Does an organization need both managers and leaders?

OR

4(a') What are the various levels of control system in an organization? Explain the four fundamental steps for any control process.

4(b') What is the importance of employee motivation? Explain the difference between human relation approach and human resource approach.
4'(c) What is the concept of job specialization? Compare the benefits and limitations of job specialization.

5(a) Explain exponential smoothing method of demand forecasting. A company has experienced irregular and usually increasing demand for disposable kits. The demand for September was 300 units and for October were 350 units. Using 200 units as September forecast and a smoothing coefficient of 0.7, calculate the forecast for the months of October and November.

5(b) A television manufacturer requires 24,000 two-centimetre-long pieces of wire every month for assembly. Ordering costs are estimated at $42, and cost of carrying is 25 percent of unit price, which is $0.08. Assuming delivery is instantaneous, find the reorder point and economic order quantity.

5(c) Explain the difference between macroeconomics and microeconomics in the context of financial management.