2015-16
B.TECH. (WINTER SEMESTER) EXAMINATION
COMPUTER ENGINEERING
DISTRIBUTED AND PARALLEL SYSTEMS
CO-405

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) Consider a k-segment pipeline (with each segment processing time \( t_p \)), used to execute \( n \) tasks, if the time required by non-pipeline unit to complete each task is \( t_n \).
(i) Calculate the speedup,
(ii) Calculate the speedup if \( n \gg k \),
(iii) Calculate speedup if time taken to process a task is the same in the pipeline and non-pipeline circuits,
(iv) Explain the case of instruction pipeline with the help of 4-segment pipeline.

1(b) State Amdahl’s laws. If in an algorithm 40% of the computation can be parallelized, what is the maximum speedup we can expect from using 4 processors?

1(c) Given the main memory address is of 18 bit and cache memory size is 2KB. If size of one block is 16B. Find out number of bits used in tag, block, word and set field for Direct, Full Associative and 2-way Set Associative mapping. Discuss the advantages and disadvantages of Direct, Full Associative and Set Associative mapping techniques.

2(a) Design a PRAM algorithm for merging two sorted lists of size \( n/2 \), compare its complexity with a sequential algorithm.

2(b) Design a PRAM algorithm to perform list ranking of \( n \) elements on a linked list.

2(c) Design a PRAM algorithm to perform graph colouring, on a graph of \( n \) vertices, with \( c \) colours and \( n \times n \) adjacency matrix.

OR

Contd.....2.
2′(a) Generalize the Coffmann-Graham algorithm to handle the task graphs in which tasks can have arbitrary integer execution time.

2′(b) Design a PRAM algorithm to perform preorder traversal of a tree with n elements, with a time complexity of $\Theta(\log n)$, discuss the various data structures being used and how the complexity of $\Theta(\log n)$ is achieved.

3(a) Design a SIMD matrix multiplication algorithm to achieve reduced time complexity of $O(n^2)$ compared to SISD $O(n^3)$ algorithm. Further improve the time complexity to $O(n\log n)$ by routing the data using SIMD hypercube interconnection network.

3(b) Design a shuffle-exchange SIMD algorithm for summation of n numbers using p processors, show the steps of the algorithm for $p=8$ and $n=16$ elements 
\{0,1,2,3,4,5,6,7,8,9,10,11,12,13,14,15\}. Calculate the complexity of the algorithm.

3(c) Write an algorithm to add $n^{3/2}$ values in $\Theta(n)$ time on a processor array with n processing elements organized in a $\sqrt{n} \times \sqrt{n}$ mesh. Assume each processing element initially contains $\sqrt{n}$ values.

OR

3′(a) Design an algorithm on SIMD architecture with mesh-interconnection of PE's to sort elements using Batcher's odd-even merge sort. Considering $t_R$ be the routing time required to move one item from a PE to one to its neighbours and $t_C$ be the comparison time for one comparison. Find out the complexity for the algorithm $M(j, 2)$ and $M(j, k)$ where $j$ is the no of rows and $k$ is the no of columns in the mesh. Show that the algorithm $M(n, n)$ has the complexity of $O(n)$.

3′(b) Find the no of steps required to route data between the two farthest element in a $\sqrt{N}$ x $\sqrt{N}$ mesh, n-cube network and N PE shuffle-exchange network. ($N=2^n$ PEs)

4(a) Design a PRAM algorithm to compute the prefix sum of n numbers with a complexity of $\Theta(\log n)$.

4(b) State Brent's theorem with its proof.

4(c) Modify the algorithm in part (a) to a cost-optimal PRAM algorithm.
B.TECH. (WINTER SEMESTER) EXAMINATION
COMPUTER ENGINEERING
SELECTED TOPICS IN COMPUTER APPLICATIONS
CO438

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
1(a) In Association Rule Mining, what is the anti-monotone property? How is this property utilized in the Apriori Algorithm? Explain.
1(b) In a corpus of 100 documents, the stop-word removal and stemming has already been carried out. For one of the documents \(d_i\) from this corpus, the data pertaining to the frequencies of all the words therein is given as follows.

<table>
<thead>
<tr>
<th>Words</th>
<th>Frequency of this word in (d_i)</th>
<th>No. of other documents in the corpus that contain this word</th>
</tr>
</thead>
<tbody>
<tr>
<td>(w_1)</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>(w_2)</td>
<td>1</td>
<td>99</td>
</tr>
<tr>
<td>(w_3)</td>
<td>23</td>
<td>0</td>
</tr>
<tr>
<td>(w_4)</td>
<td>23</td>
<td>99</td>
</tr>
<tr>
<td>(w_5)</td>
<td>12</td>
<td>42</td>
</tr>
</tbody>
</table>

Find out the relevance of each word to that document \(d_i\) using TF-IDF method.

OR

1'(a) How are the problems of Content Based techniques solved by the Connectivity Based ones?
1'(b) What linguistic quantifier is used in the Improved Shimura Technique of Rank Aggregation and why? Explain by stating the Condorcet Criterion.

2(a) Why is the problem of Rank Aggregation considered to be NP-hard? Explain.
2(b) For the graph given below, show that \(\sum_{\forall j} R(p_j) = 1\), where \(R(p_j)\) is the PageRank value of the \(j^{th}\) node.

Contd.....2.
2'(a) Explain the procedure(s) for converting a partial list into a full list. Give suitable examples.

2'(b) Find out the sequence of listing of resources \( R_1 = (\neg a_1 \lor a_2) \land a_3 \) and \( R_2 = (a_2 \land a_4) \lor (a_1 \land a_2 \land a_3) \) in response to the query \( Q = a_1 \land a_3 \), using:
   (i) Radecki method
   (ii) Li & Danzig method

3(a) How is Fuzzy Search Quality Measure better than the one which uses an empirical formula instead? Explain.

3(b) Find out the Fuzzy Preference Relation \( R_v \), from the user preference ordering given by the sequence vector \( V = (4, 1, 6, 3, 5, 2) \).

4(a) Describe the different protoforms of the Generalized Constraint Language (GCL) that are used for Precesiciated Natural Language (PNL).

4(b) Evaluate: "As many as possible" \((0.4, 0.3, 0.6, 0.4, 0.8, 0.5)\).
2015-2016  
B. TECH. VIII TH WINTER SEMESTER EXAMINATION  
(COMPUTER ENGG.)  
VLSI DESIGN TOOLS AND TECHNIQUES  
(CO-442)  
Credit - 04

Maximum Marks: 60  
Duration: Three Hours

- Attempt All questions.  
- Symbols and notation used have their standard meanings.  
- Assume suitable data if required.

1(a) Describe VLSI design flow with the help of D.Gajski “Y” Chart and Flow Chart 8

(b) Sketch the Stick diagram and Layout of a 2-Input XOR gate with two different orientations. Use colour code for the Layout. 7

2(a) How the Stuck At-0 (SA-0) fault can be detected from the NOR gate E in the figure 1. Give the entire input pattern for which the fault can be detected. 7

(b) Prove that, decrease in biasing voltage increases the delay and decreases the power consumption. 8

(b') i. What is the cause of power consumption in combinational logic circuits? 5
ii. What are the different types of faults, caused by the manufacturing defects in a logic circuit? 3

OR

3(a) What is Pipelining? Why it is used in VLSI design? 3

(b) How does the carry look-ahead-adder speed up the process of addition? Explain. 9
Derive the expression for fourth stage carry (C₃) of a carry look ahead adder

(b) Why it is much harder to test the faults in a sequential machine? 3

OR

3'(a) Design the architecture for a 8-bit carry-select adder and explain its operation 7

(b) Use 3-bit Booth code to multiply 27 and -13, consider -13 is the multiplier. Illustrate the steps of multiplication. 8

Contd.....2.
4. (a) Under what condition a cyclic constraint graph is obtained in the problem of compaction in VLSI design. Evaluate the longest distance of each vertices of the graph shown in figure 1, from the vertex \( V_0 \). Use suitable longest path algorithm.

(b') A graph obtained from the building block of a system is shown in figure 2. Partition the graph into two for the placement, use Kernighan-Lin Algorithm. Initial partition of the graph is shown in figure with a dotted line.
2015-16
B.TECH. (WINTER SEMESTER) EXAMINATION
COMPUTER ENGINEERING
MULTIMEDIA TECHNOLOGIES
CO-450

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) Why is compression important in multimedia? [03]

1(b) Explain the following terms with examples:
   i. Discrete Multimedia
   ii. Non-linear Multimedia
   iii. Hypermedia
   [3×2]

1(c) What do you mean by color models? Write the steps to convert RGB color value into the corresponding CMYK color value and vice-versa. [2+4]

   OR

1(c') Briefly describe the different types of video signals. [6]

2(a) What are the implications of Nyquist's Sampling Theorem for multimedia data? [03]

2(b) What do you mean by DC and AC coefficients in JPEG image compression?
Briefly describe about the quantization and vectoring process of this technique. [2+4]

2(c) Encode the stream of characters MEDIA using arithmetic coding compression. [06]
You may assume that characters occur with probabilities of
\[ M = 0.1, E = 0.3, D = 0.3, I = 0.2 \text{ and } A = 0.1 \]

   OR

Contd.....2.
2(e') Show how you would use Huffman coding to encode the following set of tokens:

BABACACADADABBCEBEBEDDABEEBB

How is this message transmitted when encoded?

3(a) What are meant by the terms frequency and temporal masking of two or more audio signals?

3(b) Briefly describe about Linear Predictive Coding in audio.

3(c) Given the following string as input, /TAN/HAN/HAN/AN/, with the initial dictionary below, encode the sequence with the LZW algorithm, showing the intermediate steps.

<table>
<thead>
<tr>
<th>Index Entry</th>
<th>Index Entry</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>/</td>
</tr>
<tr>
<td>2</td>
<td>H</td>
</tr>
<tr>
<td>3</td>
<td>A</td>
</tr>
<tr>
<td>4</td>
<td>N</td>
</tr>
<tr>
<td>5</td>
<td>T</td>
</tr>
</tbody>
</table>

OR

3(e') Briefly describe the MPEG Perceptual Audio Coding with suitable diagrams.

4(a) What do you mean by Motion Estimation and Compensation of a video?

4(b) Write a short note on MPEG-1 coding standard. What are the advantages of MPEG-2 over MPEG-1?

4(e) Explain different type of frames of a video along with their encoding techniques.

OR

4(e') A digitized video is to be compressed using MPEG-1 standard. Assume the frame sequence is IBBPBBPBBB.... Average compression ratio of I-frame is 10:1, P-frame is 25:1 and B-frame is 50:1. Find the average bit rate that is generated by the encoder for the PAL video (Frame resolution: 352×288).

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Q.No. Question M.M.
1(a) Differentiate among IS-54, IS-136, GSM, IS-95, GSM-1800, CDPD, GPRS, EDGE, IS-95B, cdma2000, UMTS, HSDPA, HSUPA, HSPA+, Wi-MAX, LTE and LTE-Advanced. List the characteristic features of these technologies and mobile generation they belong to. [08]
1(b) List the various major mobile radio standards for North America describing the type of technology, year of introduction, multiple access, frequency band, modulation and channel width. [07]

OR

1(b') For the current and emerging 2.5G and 3G mobile communication standards, HSCSD, GPRS, EDGE, W-CDMA, IS-95B, cdma2000 1xRTT, cdma200 1xEV (DO and DV) and cdma200 3xRTT, give the channel BW, duplexing, infrastructure change and spectrum requirements in a tabular format. [07]

2(a) Discuss the D-AMPS model of cellular telephony. What is the operating frequency, channel width, frequency reuse factor and number of channels for D-AMPS? Draw suitable diagrams. [08]

2(b) What is the difference between Inter-BS Handoff and Intersystem Handoff? Support your answer with suitable diagrams. [07]

OR
2(b') Explain the MS registration process and call delivery procedure while roaming in cellular networks. Where do the entities HLR and VLR reside?

3(a) Explain the different interfaces used in GSM/GPRS network architecture. What additional equipment are installed in GSM networks at the BSS and the MSC for GPRS deployment? Support your answer with suitable network diagrams.

3(b) Explain the Tromboning trunk setup in signalling relay function in Mobile Number Portability (MNP)? Draw suitable diagrams to support your answer.

OR

3(b') What is Cellular Digital Packet Access (CDPD)? How is it integrated on the D-AMPS mobile architecture? Explain with the help of a suitable network diagram.

4(a) With the help of suitable network diagram explain the 3G(PP) Architecture. What are the various interfaces used in a 3G UMTS mobile network?

4(b) Name some of the 3G field trial systems. Discuss in detail the Lucent cdma2000 3G field trial system.

OR

4(b') For the DoCoMo W-CDMA field trial system, explain the DoCoMo mobile station configuration and the DoCoMo base station equipment. Draw suitable diagrams to support your answer.