

Final Assessment Test (FAT) – November/December 2022

Programme	B.Tech.	Semester	Fall Semester 2022-23
Course Title	PARALLEL AND DISTRIBUTED COMPUTING	Course Code	CSE4001
Faculty Name	Prof. S Venkatraman	Slot	D2
		Class Nbr	CH2022231000220
Time	3 Hours	Max. Marks	100

Part A (10 X 10 Marks)
Answer All questions

1. Data parallelism is parallelization across multiple processors in parallel computing environments. It focuses on distributing the data across different nodes, which operate on the data in parallel. It can be applied to regular data structures like arrays and matrices by working on each element in parallel. Explain at least two variations of how processors exploit data-level parallelism in detail. [10]

2. (i) Information security analyst would like to encode the data available in the **input.txt** file as follows [10]

the sample content of **input.txt** file

1234511 2345555 7877888

Applying Encoding technique

1234511 (1 -> 100011 2 -> 01000000 3 -> 0010000 4 -> 0001000 5 -> 0000100)

2345555 (2 -> 1000000 3 -> 0100000 4 -> 0010000 5 -> 001111)

7877888 (7 -> 1011000 8 -> 0100111)

In this type of encoding, a bit string (whose number of bits is equal to the size of the value) is associated with each possible unique element of the number, with a '1' in the i^{th} corresponding unique element position in the bit string otherwise 0 in the remaining positions.

(i) Develop an OpenMP program that reads a text file **input.txt** and applies the encoding on the content of the file and stores the encoded data in the **output.txt** file. (8 Marks)

(ii) Discuss how the output will be generated as per your program and hence stored in the **output.txt** file. (2 Marks).

3. Write an efficient code using CUDA to convert the given RGB image to a grayscale image. [10]

Grayscale is obtained from RGB image using the below equation.

$$\text{grayscale} = (\text{red} + \text{green} + \text{blue}) / 3$$

Sample Input:

Red : [2 2 3

4 5 6

7 8 9]

Green : [2 1 2

3 6 8

4 5 8]

Blue: [2 3 4

5 7 1

1 2 1]

Sample Output: [2 2 3

4 6 5

4 5 6]

4. Given the set of database transactions from the PQR online purchase platform from the following tables, Table 1 and Table 2.

[10]

Transactions
Bread, Jam, Tooth brush
Mobile, Mobile cover, Head phones, Tamper glass, Bread, Jam, Scissor, Knife
Bed sheets, Mobile cover, Head phones
Mobile, Head phones, Jam, Butter, Scissor, Knife, Bread
Jam, Butter, Ear rings, Bangles, hair oil
Bangles, Hair oil, Shampoo, Hair comb
Scissor, Knife, Bread, Butter
Bed sheets, Bangles, Hair oil, Shampoo

Table 1

Item sets	Frequency
Ear rings, Bangles	2
Mobile cover, Head phones	?
Bread, Jam	?
Bangles, Hair oil, Shampoo	?
Jam, Butter	?
Scissor, Knife	?
Head phones, Tamper glass	?
Scissor, Knife, Bread	?

Table 2

Identify and explain in detail any three possible decomposition strategies that can be adopted to compute the frequency of the item sets (count of the occurrence of item sets in the same order) that are purchased. Design the most efficient parallel algorithm model with pseudo code.

5. Teacher teaches alphabets to the kids. Teacher has given words to the kids which is mixture of upper and lower case letters and asked the students to move the uppercase letters at the beginning of the words and lowercase letters at the end of the word. The words given by the teachers are available in **words.txt** file and teacher has asked to store the words in **final.txt** file after arranging the upper and lower case letters. Ensure that the order of the words in the **final.txt** file should be same as the **words.txt** file.

For your better understanding the sample content of the both files are given below.

words.txt

Hello hoW aRe You? All thE bEST to your FAT pDc eXams.

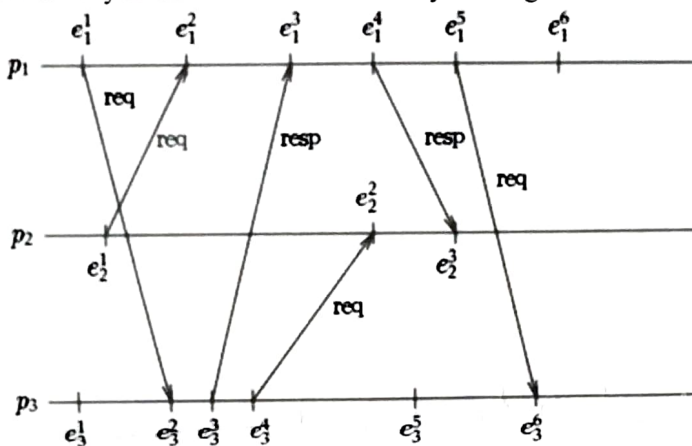
final.txt

HOell Who Rae You? All Eth ESbt to your FAT Dpc Xeams.

Develop an efficient MPI program for this scenario.

6. Railway reservation system maintains the **train.txt** file which has details (train number, to, from, no of available tickets). Provide the facility for the user to check the availability of the tickets from the remote server for a particular train number. If the required tickets are available for a particular train, then send the "success" message else send "sorry" message to the client. Develop a suitable complete RMI application for this scenario. [10]

7. • A distributed computation is the act of a group of processes running a set of distributed programs. The space-time diagram for distributed computing is provided below. To demonstrate inconsistent, consistent, and strong consistent cuts, draw at least three lines and Prove that the cuts are consistent, strongly consistent, and inconsistent by applying your mechanism. [10]
- How do you ensure the distributed system's global states are deadlocks-free? (2)



8. Assume that there are four processes, P0, P1, P2, and P3, running Maekawa's algorithm for mutual exclusion. The voting sets for P0, P1, P2, and P3 are given as $V0 = \{P1, P3\}$, $V1 = \{P0, P2\}$, $V2 = \{P1, P3\}$, and $V3 = \{P0, P2\}$ respectively. Using the four processes and their voting sets, describe a concrete scenario (i.e., a step by step action sequence) where Maekawa's algorithm does not provide liveness with neat sketch. (6M) Modify the voting sets such that liveness will be always met for the above scenario and justify the same (4M) [10]
9. Consider VIT Library Systems (VLS) handles book transactions (Issue and Return) of students. Let student A from VIT Vellore returns an e-book "B1" which is requested by another student "C" from VIT Chennai. Identify the appropriate algorithm and elaborate on the same by which the above-distributed transaction can complete without any issues. Assume one e-book can be issued to only one student at a time. [10]
10. Consider a networked system 'S' with 'N' servers. If you want to make your system 'S' to be a content-aware scalable cluster, how will you configure your dispatcher and distributor? Justify your answer in detail with comparison to other approaches. Illustrate your explanation with a neat diagram. [10]

