

**B.E. COMPUTER SCIENCE & ENGINEERING 4<sup>th</sup> YEAR 2<sup>nd</sup> SEMESTER EXAM- 2022****DISTRIBUTED COMPUTING**

Time:

Full Marks: 70

**Group A (Total Marks: 30) [CO1]****Answer Question No. 1 (Compulsory) and Question No. 2 OR Question No. 3**

1. a) What are the benefits of distributed systems? Discuss some disadvantages of distributed systems that local only systems do not show. 2+2  
 b). Explain how a distributed system projects a single system image. What is the role of transparency in a distributed computing environment? What are the different forms of transparency? 3+2+3  
 c) What is a Single-point-of-failure? What type of distribution is used to handle a SPOF in a single database? How load balancing problems can be tackled using different types of distributions. (Explain with examples and figures) 2+2+4
2. Explain the working procedure of BitTorrent with a suitable diagram. Is it possible to design BitTorrent as a trackerless system? Justify your answer with technical details. 5+5
3. Describe the peer selection approaches used in Napster, Gnutella and KaZaA. Describe the functionalities of main components of Skype as an example of Voice over Overlay Network. 6+4

**Group B (Total Marks: 20) [CO2 and CO3]****Answer Question No. 4 OR Question No. 5 and Question No. 6 (Compulsory)**

4. a) Describe the AWS serverless platforms and its benefits with Compute, Storage, Data Stores and API Proxy services. 5  
 b) What are the main limitations of MapReduce? How Spark can overcome those issues. Explain the working procedure of Spark with a suitable example and diagram. 5
5. List the characteristics of a computational Grid. Briefly specify the functionality of the software modules GRAM, GSI, MDS, GridFTP and GASS implemented in Globus toolkit middleware library. Try to illustrate an example application in using each of the five functional modules. 3+7
6. Explain the split driver model based I/O virtualization technique in XEN with a suitable diagram. Describe pre-copy and post-copy VM live migration techniques. Compare these two techniques in terms of performance metrics. What are the main problems of virtualization? Explain how container based resource management can address these issues. 3+3+4

**Group C (Total Marks: 20) [CO4]****Answer Question No. 7 (Compulsory) and Question No. 8 OR Question No. 9**

7. a) You are synchronizing your clock from a time server using Cristian's algorithm and observe the following times:

- timestamp at client when the message leaves the client: 6:22:15.100
- timestamp generated by the server: 6:21:10.700
- timestamp at client when the message is received at client: 6:22:15.250

To what value do you set the client's clock? If the best-case *round-trip* message transit time is 124 msec (0.124 sec), what is the error of the clock on the client?

b) A system of four processes, ( $P_1, P_2, P_3, P_4$ ), performs the following events:

- $P_1$  sends a message to  $P_3$  (to event e).
- $P_1$  receives a message from  $P_3$  (from event g).
- $P_2$  executes a local event.
- $P_2$  receives a message from  $P_3$  (from event f).
- $P_3$  receives a message from  $P_1$  (from event a).
- $P_3$  sends a message to  $P_2$  (to event d).
- $P_3$  sends a message to  $P_1$  (to event b).
- $P_4$  executes a local event.

When taking place on the same processor, the events occur in the order listed. Assign Lamport timestamps to each event. Assume that the clock on each processor is initialized to 0 and incremented before each event. For example, event *a* will be assigned a timestamp of 1.

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|------|----|----|----|
| a. 1 | b. | c. | d. |
| e.   | f. | g. | h. |

c) Assign vector timestamps to each event (above). Assume that the vector clock on each processor is initialized to (0,0,0,0) with the elements corresponding to ( $P_1, P_2, P_3, P_4$ ). For example, event *a* will be assigned a timestamp of (1, 0, 0, 0). Which events are concurrent with event *d*?

2+5+3

8. Explain the concept of "Release consistency model". What modification over "Release consistency model" leads to "Lazy release consistency model"? Explain with a proper example and diagram. 5+5
9. Discuss three properties of the weak consistency model. Explain weak consistency with a valid and invalid sequence of events. 10