Ex/PG/CSE/T/127B/2017

M.E. COMPUTER SCIENCE AND ENGINEERING FIRST YEAR SECOND SEMESTER – 2017

DISTRIBUTED SYSTEMS

Time: 3 hours Full Marks: 100

Answer question 1 and any four questions
All questions carry equal marks

1. Answer and ten. For each of the following statements, say if it is true or false. Explain your answer. 10X2=20

   i. A peer-to-peer architecture is always more efficient that a centralized architecture.
   ii. The RPC model of communication is necessarily synchronous.
   iii. Virtualization can improve the portability of applications.
   iv. FTP is an example of an application-layer protocol.
   v. Mobile agent should be a serializable object.
   vi. In order for processes to cooperate, they must communicate.
   vii. Any global interleaving of operations is valid as long as the interleaving satisfies all processes.
   viii. Token ring requires the ability to construct a logical ring of processes based on the group.
   ix. A synchronization subnet is the collection of NTP servers on the Internet.
   x. Logical clocks measure the time of day in a distributed environment.
   xi. TCP does not guarantee in-order packet delivery.
   xii. Cloud computing provides on-demand functionality.

2. a) Give a definition of middleware and show in a small diagram where it is positioned. With examples describe- access, location and migration transparency in a distributed system. 4+6

   b) What are the two main theoretical difficulties to face when writing distributed algorithms? Explain the working procedure of peer to peer networking in BitTorrent application. 4+6

3. a) Draw an architecture of Grid environment and briefly explain 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. 10

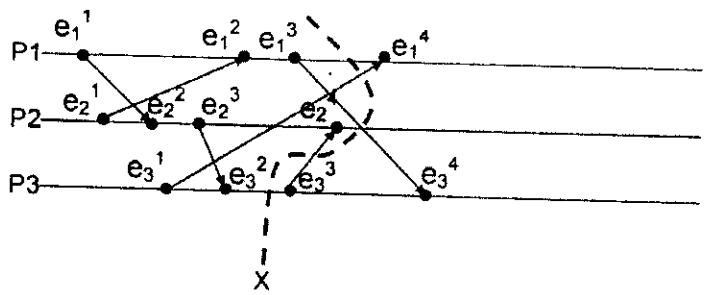
   b) Compare cluster computing and cloud computing. Discuss and compare different cloud delivery models. Explain the difference between full virtualization and para virtualization. 3+3+4

4. a) For heavily-loaded servers, what will you recommend UDP or TCP- Justify your answer. When passing data values between different machines with different operating systems what problems have to be solved? When calling a remote procedure or method where a reference parameter is passed, what problems have to be solved and how are they solved? 4+3+3

b) Design a mobile agent framework and write significate parts of the application (in your preferred language) to enable following services: (i) locating agent hosts in the environment; (ii) hosting of multiple mobile agents; (iii) moving to new host; (iv) executing some task in the new host. 10

5. a) At 10:27:540 (hr, min, 1/100 sec.), server B requests time from the time-server A. At 10:27:610, server B receives a reply from timeserver A with the timestamp of 10:27:375. Find out the drift of B's clock with respect to the time-server A's clock (assume there is no processing time at the time-server for time service). Is B's clock going too fast or too slow? If the answer is yes, by how much is the clock going too fast or too slow? How should B adjust its clock? 5+2+3

b) Consider the figure below showing three processes P1, P2, P3. Is the run $<e_1^1, e_2^2, e_2^3, e_3^2, e_2^4, e_3^3>$ a linearization of events? Explain why or why not. Is the cut, shown by curve X in the figure, a consistent cut? Why? 5+5



6. a) Give three examples of different consistency models. For each pair of models, give a sequence of events that is allowed under one of the models but not the other one and explain why. 3+7

b) Give an example where the Lamport's clock algorithm comes short (i.e., the Lamport's algorithm cannot clearly conclude that event **e** happens before **e'**, even those **L(e) < L(e')**, where **L(e)** is the Lamport's timestamp of the event **e**), and the vector clock algorithm concludes clearly that event **e** happened before **e'** or not. 10

7. a) Explain in detail the Bully algorithm for electing a leader. Explain the concept of "Release consistency model". What modification over "Release consistency model leads to "Lazy release consistency model"? Explain with proper example and diagram. 5+5

b) Draw a diagram to depict the Jini architecture. What are the main components of Jini infrastructure, explain their importance in building distributed application. What types of problems are suitable for MapReduce processing? Explain how MapReduce provides high scalability. 2+3+2+3