B.Sc. Engg. CSE 8th Semester (43) 307 16 October 2014 (Morning)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
Department of Computer Science and Engineering (CSE)

SEMESTER FINAL EXAMINATION SUMMER SEMESTER, 2013-2014

DURATION: 3 Hours FULL MARKS: 150

CSE 4803: Parallel and Distributed Processing

Programmable calculators are not allowed. Do not write anything on the question paper.

There are **8 (eight)** questions. Answer any **6 (six)** of them.

Figures in the right margin indicate marks.

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a) What do you mean by transparency? Explain different types of transparencies in distributed system. 2+5

b) Define Distributed, Parallel and Concurrent computing. What are the goals of distributed systems? Explain briefly each of those goals. 3+7

c) Scalability in distributed system can be achieved by applying different techniques. What are these techniques? Explain briefly. 8

a) According to Sidney Fernback: "*Today's large computer would have been considered 'supercomputers' 10 to 20 years ago. By the same token, today's supercomputers will be considered 'state-of-the-art' standard equipment 10 to 20 years from now*". Justify the comment and explain the trends towards parallel computing. 7

b) The speed up of using n processors over the use of one processor in solving a computer problem can be analyzed under various assumptions, such as $f_i=1/n$ and $d_i=1/i$ for $i=1, 2, ..., n$. Repeat the performance speed up analysis to derive a new average speed up (S) and average time (T_n) under the following probability distributions of operating modes: 8

i. $$f_i = \frac{i}{\sum_{i=1}^{n} i}, \quad for\ i = 1, 2, ..., n$$

ii. $$f_i = \frac{n-i-1}{\sum_{i=1}^{n} i}, \quad for\ i=1, 2, ..., n$$

c) Describe the four categories of parallel computing systems according to Flynn's classification model. 10

a) Many distributed algorithms require the use of a coordinating process. To what extent can such algorithms actually be considered distributed? Discuss them. 8

b) Briefly explain the hierarchical implementation of lightweight directory access protocol (LDAP). 9

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c) Consider Figure 1. Suppose that the coordinator crashes. Does this always bring the system down? If not, under what circumstances does this happen? Is there any way to avoid the problem and make the system able to tolerate coordinator crashes?

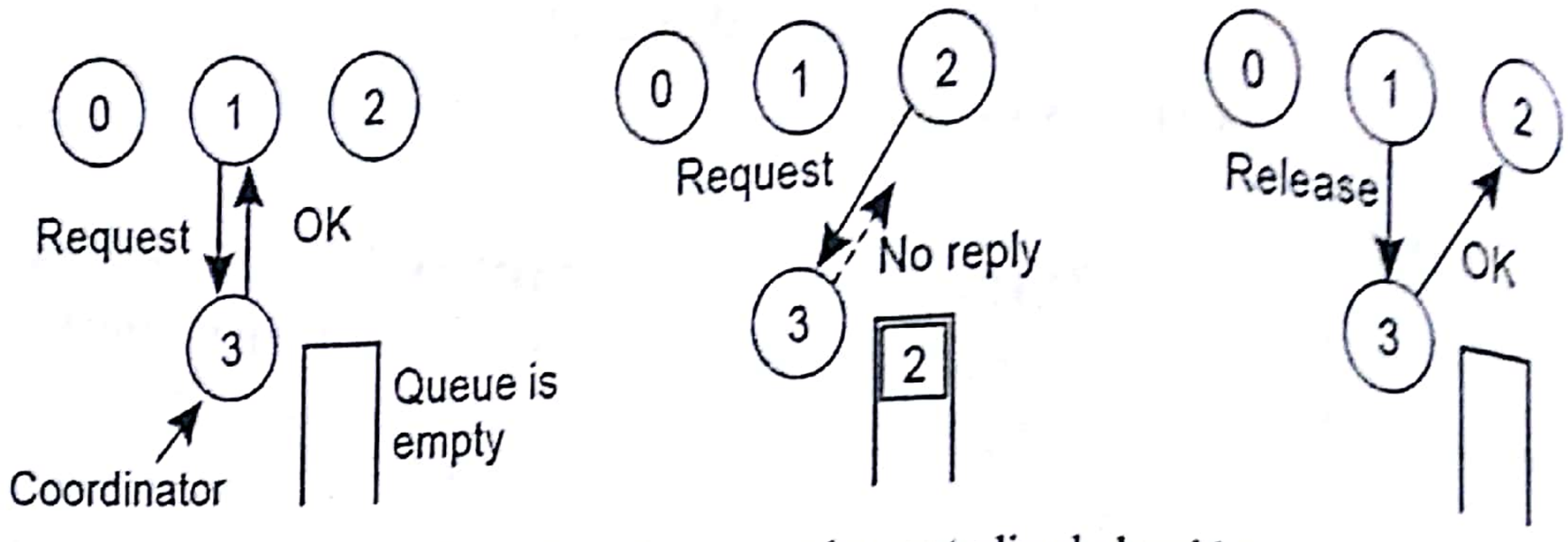

Figure 1: Critical section access by centralized algorithm

4. a) Mention the importance of clock synchronization in distributed system. Describe the Berkeley algorithm for clock synchronization with specific example.

b) In Figure 2, we have two ELECTION messages circulating simultaneously. While it does no harm to have two of them, it would be more elegant if one could be killed off. Devise an algorithm for doing this without affecting the operation of the basic election algorithm.

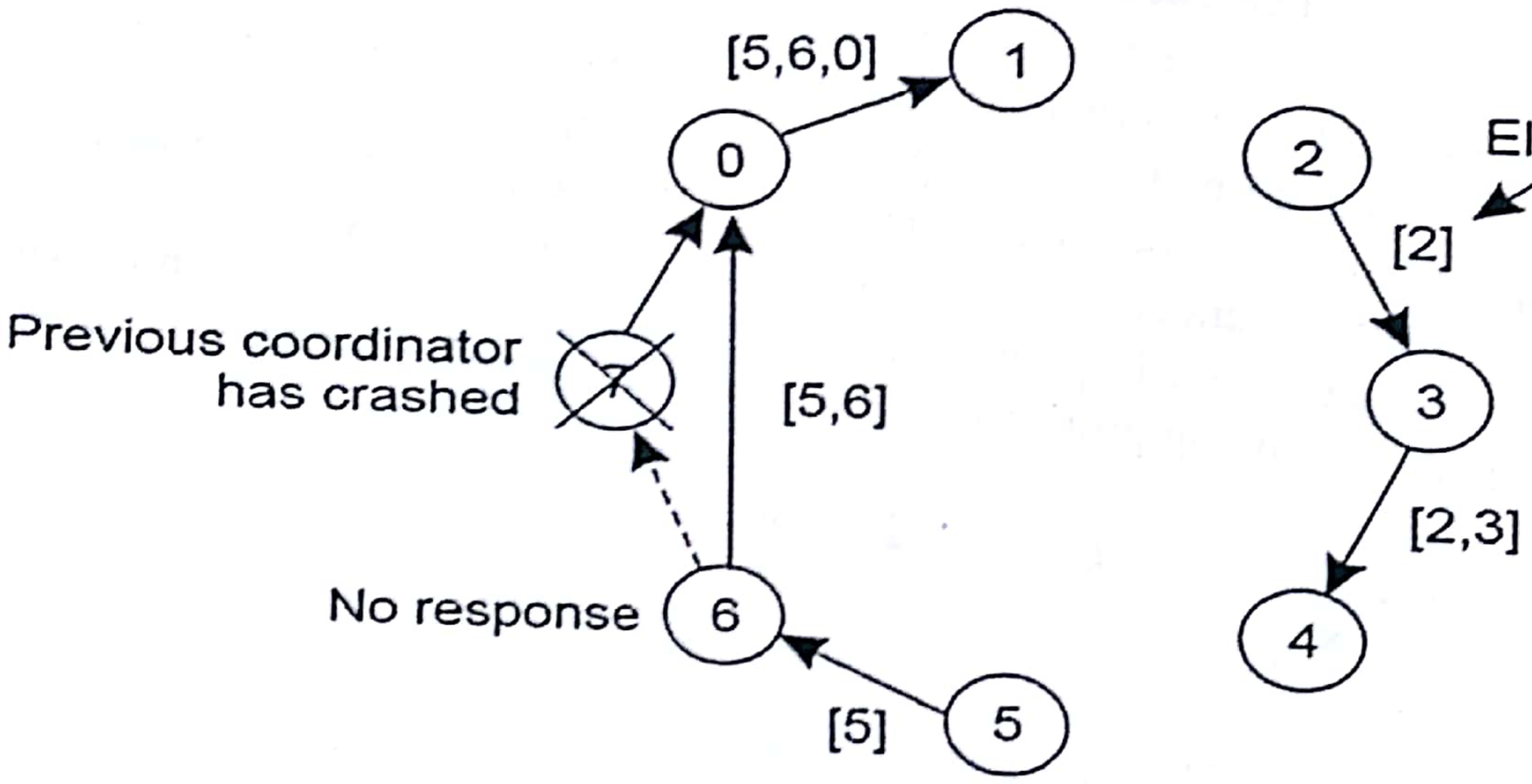

Figure 2: Election algorithm by using ring

c) Mutual exclusion can be implemented in a distributed system by different algorithms. Explain and make a comparison of centralized, distributed and token ring algorithm for mutual exclusion.

5. a) Explain the operation of current Internet architecture. Why do the researchers look for ID/locator separation architecture? Discuss it with necessary figures.

b) Consider a bit torrent system in which each node has an outgoing link with bandwidth capacity B_{out} and an incoming link with bandwidth capacity B_{in}. Some of these nodes (called seeds) voluntarily offer files to be downloaded by others. What is maximum download capacity of a BitTorrent client if we assume that it can contact at most one seed at a time?

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c) Figure 3 demonstrates the alternative client-server organization of multi-tiered architecture for distributed systems. Explain its different types with appropriate example. 10

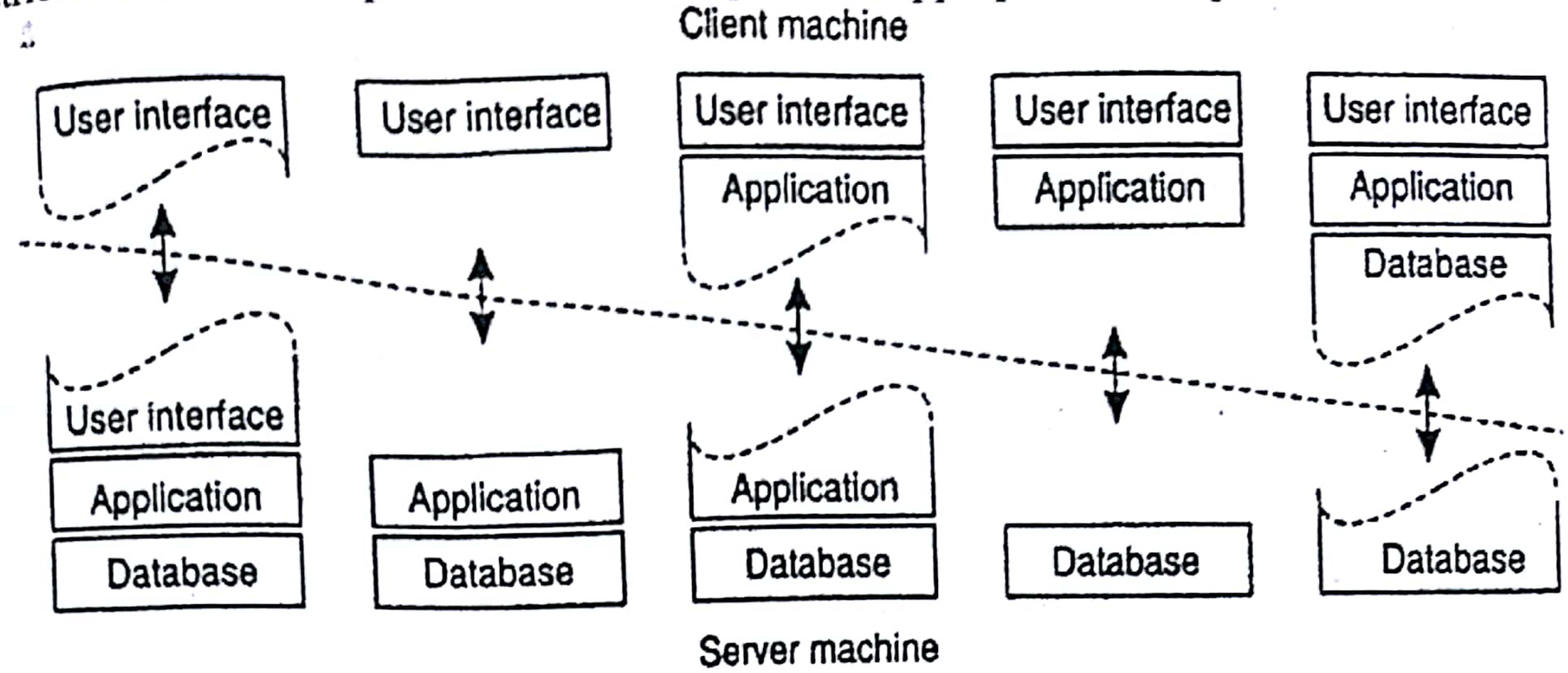

Figure 3: Alternative client-server organization for Question 5.(c)

a) What is cloud computing? Explain different types of cloud deployment model. 2+6
b) What are the roles of network in cloud computing? Explain different network architectures for cloud computing. 10
c) Mention a few of the challenges for cloud computing. Briefly explain different types of enabling technologies for cloud computing. 2+5

7. a) What do you mean by *naming in distributed system*? Compare and contrast flat, structured and attribute based naming. 2+6
b) Compare iterative and recursive name resolution. How is the name space implemented in structured naming? 4+6
c) Mention different types of record with associated entity and description for the DNS's name space. 7

8. a) Explain to what extent Google is now a cloud provider company. 5
b) The key requirements for the Google infrastructure are scalability, reliability, performance and openness. Provide three example of where these requirements might be in conflict and discuss how Google deals with these potential conflicts. 6
c) Explain why Google infrastructure supports three separate data storage facilities. Why does Google not just adopt a commercial distributed database instead of utilizing the three separate services? 8
d) Describe some applications and sketch out how these would be implemented in MapReduce, providing in particular outline implementations of the map and reduce functions. 6

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