B.Sc. Engg. CSE 8th Semester (45) 321 15 October 2015

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

SEMESTER FINAL EXAMINATION **SUMMER SEMESTER, 2014-2015**

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) Describe briefly the goals of a distributed system. Does asynchronous communication and Domain Name Service help us achieve any of these goals? How? 5+4

b) What do you understand by Distributed Pervasive Network? Assume you are tasked to design a "smart product purchase recommendation system" which will track the consumption habit of users and recommend different products to be procured by the users along with the location from where they can purchase them. Provide the network description for the system. It should be realized that connectivity between different appliances and sensors should play the vital role in designing the system. 2+6

c) Define Horizontal and Vertical Distribution. Describe different pitfalls developers face while implementing a distributed system. 4+4

a) Describe some of the major software architectural styles for different distributed systems with proper diagrams. 8

b) In multi-tired architecture for a distributed system, the organization of the client and server can be different. With proper example, describe each of the organizations. 10

c) What is SON? With appropriate figures, describe the working principles of Skype, Gnutella and KaZaA. 1+6

a) Assume that a distributed peer-to-peer communication system is implemented using Chord System where there can be at most 32 machines in a single network and the machines can be named from 0-31. There are nine live machines in the network having the following names: 1, 6, 8, 11, 13, 16, 18, 22 and 28. Each machine has a predecessor and a successor. Predecessors and successors are selected based on the numeric values of their names. For example, the machine '6' has machine '1' as its predecessor and '8' as its successor. Also assume that the length of each finger tables, they have generated are of length 5.
Your task is to calculate **finger tables** for each of these live nodes. Now, let a new machine has asked to join the network. Describe how the new machine will resolve its position in the network if its name is 26. What would happen if any machine of the network had left the network? 18

b) Describe the process of implementing a foreign namespace in a distributed system. 7

4. a) What is clock drift? Briefly describe the Barkley's algorithm for clock synchronization. 2+5

b) Design a mutual exclusion algorithm that allocates resources based on "Majority Rule" policy. Also discus the probability of failure for the algorithm. 5+3

c) Design an Election algorithm for the wireless network described in Figure 1, where the nodes are wireless devices and edges define connection between two wireless devices. 10

Your algorithm should consider battery power left in each wireless device into account, which is defined as numeric values inside the nodes.

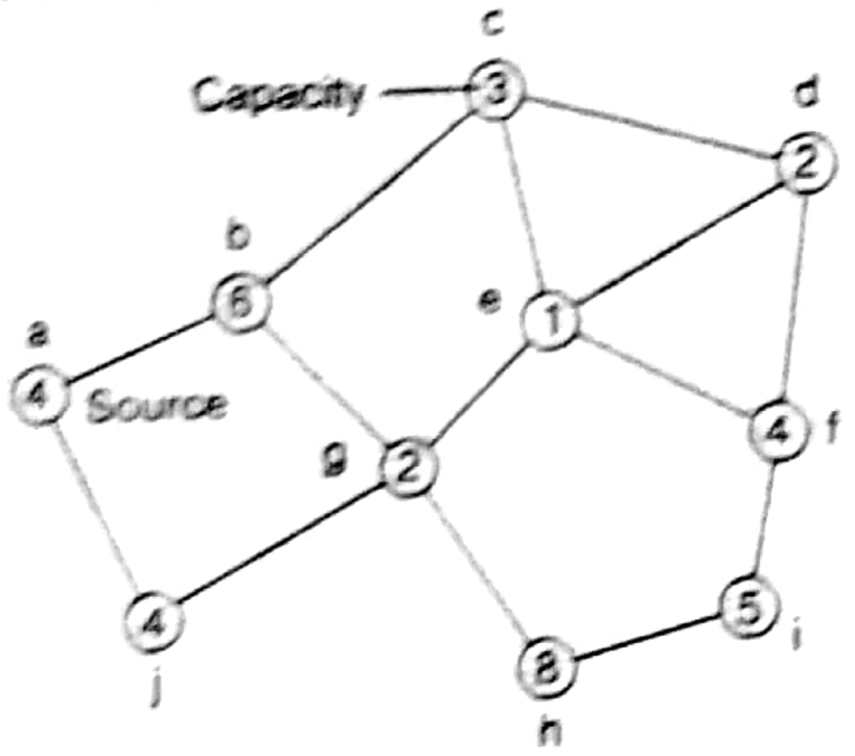

Figure 1: Wireless network for question 4.(c).

5. a) A part of DNS file is given in Table 1. Describe the meaning of the entries and how names are resolved based on the given table. 10

Table 1: Partial DNS table for question 5.(a)

Name	Record type	Record value
cs.vu.nl.	SOA	star.cs.vu.nl. hostmaster.cs.vu.nl. 2005092900 7200 3600 2419200 3600
cs.vu.nl.	TXT	"Vrije Universiteit - Math. & Comp. Sc."
cs.vu.nl.	MX	1 mail.few.vu.nl.
cs.vu.nl.	NS	ns.vu.nl.
cs.vu.nl.	NS	top.cs.vu.nl.
cs.vu.nl.	NS	solo.cs.vu.nl.
cs.vu.nl.	NS	star.cs.vu.nl.
star.cs.vu.nl.	A	130.37.24.6
star.cs.vu.nl.	A	192.31.231.42
star.cs.vu.nl.	MX	1 star.cs.vu.nl.
star.cs.vu.nl.	MX	666 zephyr.cs.vu.nl.
star.cs.vu.nl.	HINFO	"Sun" "Unix"
zephyr.cs.vu.nl.	A	130.37.20.10
zephyr.cs.vu.nl.	MX	1 zephyr.cs.vu.nl.
zephyr.cs.vu.nl.	MX	2 tornado.cs.vu.nl.
zephyr.cs.vu.nl.	HINFO	"Sun" "Unix"
ftp.cs.vu.nl.	CNAME	soling.cs.vu.nl.
www.cs.vu.nl.	CNAME	soling.cs.vu.nl.
soling.cs.vu.nl.	A	130.37.20.20
soling.cs.vu.nl.	MX	1 soling.cs.vu.nl.
soling.cs.vu.nl.	MX	666 zephyr.cs.vu.nl.
soling.cs.vu.nl.	HINFO	"Sun" "Unix"
vucs-das1.cs.vu.nl.	PTR	0.198.37.130.in-addr.arpa.
vucs-das1.cs.vu.nl.	A	130.37.198.0
inkt.cs.vu.nl.	HINFO	"OCE" "Proprietary"
inkt.cs.vu.nl.	A	192.168.4.3
pen.cs.vu.nl.	HINFO	"OCE" "Proprietary"
pen.cs.vu.nl.	A	192.168.4.2
localhost.cs.vu.nl.	A	127.0.0.1

b) Design a mutual exclusion algorithm that deterministically ensures resource allocation without starvation and dead lock. Also discuss the pitfalls of using such algorithm. 5+5

c) Describe the Home-Based approach of naming in distributed system. 5

6. a) What is RPC? How can one machine call a remote procedure using Server and Client stubs? Also discuss different techniques to pass parameters in RPC? Use proper example for explanation. 7+6

b) Consider a procedure *incr* with two integer parameters. The procedure adds one to each parameter. Now suppose that it is called with the same variable twice, for example, as incr*(i,i)*. If *i* is initially 0, what value will it have afterwards if call-by-reference is used. What if copy/restore is used? 5

c) What is Geometric Overlay network? Consider a BitTorrent system in which each node has an outgoing link with a bandwidth capacity B_{out} and an incoming link with bandwidth capacity B_{in}. Some of these nodes (seeds) voluntarily offer files to be downloaded by others. What is a maximum download capacity of a BitTorrent client if we assume that it can contact at most one seed at a time? How long will it take for a client to download a file of size 100 units if we consider the unit of time as second? 2+5

7. a) What are the ways to achieve parallel processing in single processor machines? Discuss Multiprogramming and Time Sharing in details. 2+4+4

b) Classify machines in terms of architectural schemes based on multiplicity of instructions and data streams. 12

c) What are the differences among Data, Information, Knowledge and Intelligence from the viewpoint of computer processing? 3

8. a) Describe the overall architecture of Google search engine with proper diagram. 8

b) Discuss the interface of BigTable. Why Google needs BigTable as their database? 4+2

c) What is MapReduce algorithm? Describe the Interface and Architecture of the MapReduce Algorithm with proper example. Also discuss how the algorithm implements Fault Tolerance. 8+3