Uppsala University

Department of Information Technology

Distributed Information System (1DT057)

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Student name: _____

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Instructions to candidates:

- This is a **FIVE(5)** hour examination.
- Answer **ALL** questions in English.
- The total mark is 100.

Question 1

(a) Describe the OSI seven layer model. Name each of the layers in the model and draw a diagram that shows the ordering of these layers. [7 pts]
(b) Write a paragraph describing the areas of function that each layer is responsible for. [7pts]

Question 2

(a) Name two well-known data transport protocols provided by the Internet Transport Layer. [4 pts]

(b) Provide a brief description for each of the above protocols and indicate what type of applications might use that service. [6 pts]

Question 3

(a) Discuss the hierarchy and addressing issues surrounding the construction of large networks. [6 pts]
(b) Comment on the current status of IPv4 in this context. Identify the major emerging problems for IPv4 and discuss how they are addressed in IPv6. [4 pts]

Question 4

(a) Discuss the difference between datagram and circuit switched traffic in communication networks. [4 pts]

(b) What are the advantages and disadvantages with each of these approaches to data delivery? [4 pts]

Question 5

(a) Explain the difference between a symmetric key system and a public key system. [4 pts]
(b) Consider a network of four people (A, B, C, and D), each person wants to communicate with any individual confidentially. How many keys does each person hold if symmetric key encryption is used? Similarly, how many keys does each person hold if public key system is used? [6 pts]

Question 6

Consider a datagram network using 32-bit host addresses. Suppose a router has four links, numbered 0 through 3, and packets are to be forwarded to the link interfaces as follows:

Destination Address Range	Link Interface
11100000 00000000 00000000 00000000 to 11100000 11111111 11111111 11111111	0
11100001 00000000 00000000 00000000 to 11100001 00000000 11111111 11111111	1
11100001 00000000 00000000 00000000 to 11100001 11111111 11111111 11111111	2
Otherwise	3

(a) Provide a forwarding table that has four entries, using longest prefix matching, and forwards packets to the correct link interfaces. [4 pts]

(b) Determine the appropriate link interface for datagrams with the following destination address: [4 pts]

Destination Address	Which link interface ?
11001000 10010001 01010001 01010101	
11100001 00000000 11000011 00111100	
11100001 10000000 00010001 01110111	
11100000 00111000 11001100 01011101	

Question 7

(a) What is the purpose of a middleware? [2 pts]
(b) What is interface definition language (IDL)? [2 pts]
(c) Suppose that you are now implementing an *election* service in a voting system. Define the interface to the *Election* service in CORBA IDL. [4 pts]
(d) Would at-least-once call semantics be acceptable for the *Election* service or would you recommend at-most-once call semantics? [2 pts]

Question 8

(a) What are the benefits of a distributed file system (DFS) when compared with a file system in a centralized system? [4 pts]
(b) To what extend does Sun NFS deviate from one-copy file update semantics? Construct a scenario in which two user-level processes sharing a file would operate correctly in a single UNIX host but would observe inconsistencies when running in different hosts. [6 pts]

Question 9

(a) Define the role of a firewall and draw a diagram that shows where a firewall should be positioned with relation to protecting a local network. [4 pts]

(b) Discuss the techniques that a firewall uses at different levels to prevent external attacks on the network and control traffic flow through the firewall. [6 pts]

Question 10

(a) What is the cause of network congestion? [2 pts]
(b) What is the name of the first packet switching network? [2 pts]
(c) What is the difference between broadcast and multicasting? [2 pts]
(d) What is the function of Internet Domain Name System (DNS)? [2 pts]
(e) What is concurrency control in transactions? [2 pts]

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GOD JUL (Merry Christmas)! ☺