THE BRITISH COMPUTER SOCIETY

THE BCS PROFESSIONAL EXAMINATIONS
BCS Level 6 Professional Graduate Diploma in IT

NETWORK INFORMATION SYSTEMS

27th April 2007, 2.30 p.m.-5.30 p.m.
Answer THREE questions out of FIVE. All questions carry equal marks.
Time: THREE hours.

*The marks given in brackets are **indicative** of the weight given to each part of the question.*

Calculators are NOT allowed in this examination.

1. **Please note:** All sections of this question should be answered in the context of a local area network running TCP/IP over Ethernet.

    a) Discuss the functionality of a bridge, identifying at what layer of the ISO Open System Interconnection (OSI) network model it operates, what filtering can be performed, how it handles broadcasts.   **(8 marks)**

    b) Discuss the functionality of a router, identifying at what layer of the OSI network model it operates, what filtering can be performed, how it handles broadcasts.   **(8 marks)**

    c) Explain the need for routing protocols and describe the main differences between RIP and OSPF in terms of protocol type, ease of configuration and convergence speed.   **(9 marks)**

2. a) There are seven protocol layers in the ISO Open System Interconnection (OSI) protocol. Explain the function of each layer and give examples of actual protocols used in practice.   **(14 marks)**

    b) Inter-network protocols are overlaid on underlying networks as shown in **Figure 1** on the next page. The network interface layer accepts inter-network packets and converts them into packets suitable for transmission by the transport layer of a specific underlying network. The underlying network consists of the transport, network, data link and physical layers of all the real networks that constitute the inter-network.

       Discuss the following relevant issues:

       i)   Packet assembly   **(3 marks)**
       ii) Virtual circuit packet delivery   **(4 marks)**
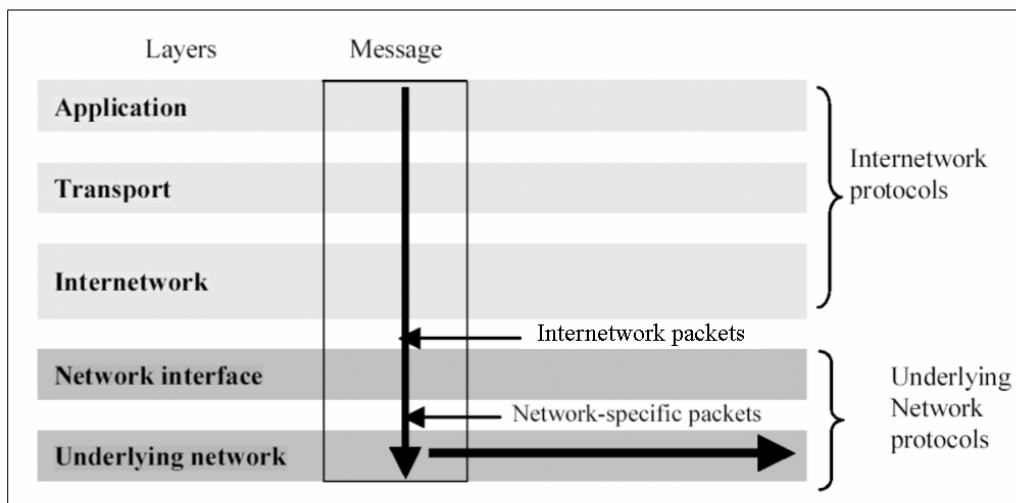   iii) Datagram packet delivery   **(4 marks)**

Figure 1: Inter-network Layers

3. *a)* Explain the structure and contents of an X.509 digital certificate. **(8 marks)**

b) Explain the main function of a certificate and discuss the role of a certificate authority in achieving this functionality. **(8 marks)**

c) Using an example explain clearly how a certificate is used to authenticate its owner when using Secure Sockets Layer (SSL). **(9 marks)**

4. *a)* Distributed processes often need to coordinate their activities. For example, if a collection of processes share a single or a collection of resources managed by a server, then often mutual exclusion is required to prevent interference and ensure consistency when accessing resources.

Explain the requirements for mutual exclusion in terms of safety, liveness and ordering. **(9 marks)**

b) The simplest way to achieve distributed mutual exclusion is to employ a server that grants permission to enter a critical section, commonly referred to as 'the central server algorithm'. **Figure 2** on the next page depicts such a server managing a mutual exclusion token for a set of processes.

Explain the structure and operation of this algorithm. **(16 marks)**
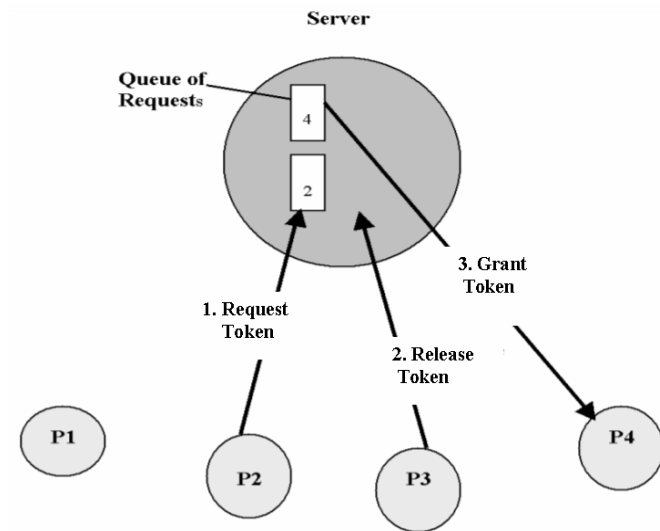
Server

Queue of Requests

4

2

3. Grant Token

1. Request Token

2. Release Token

P1

P2

P3

P4

Figure 2

5. *a)* Explain why there is a need for server side dynamic content generation on Web servers. **(4 marks)**

b) For each section below, explain the details of the technology and give examples of appropriate and inappropriate uses of the technology.

    i) Common Gateway Interface (CGI) **(7 marks)**

    ii) Server parsed HTML **(7 marks)**

    iii) Java Servlets and Java Server Pages (JSP) **(7 marks)**