BCS THE CHARTERED INSTITUTE FOR IT

BCS HIGHER EDUCATION QUALIFICATIONS
BCS Level 6 Professional Graduate Diploma in IT

NETWORK INFORMATION SYSTEMS

Monday 16th March 2020 - Morning

Answer **any** THREE questions out of FIVE. All questions carry equal marks.

Time: THREE hours

Answer any Section A questions you attempt in Answer Book A
Answer any Section B questions you attempt in Answer Book B

For all questions illustrate your answers with diagrams where appropriate

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

Calculators are **NOT** allowed in this examination.

Section A
Answer Section A questions in Answer Book A
For all questions illustrate your answers with diagrams where appropriate

A1.

a) Explain the concept of a distributed processing system and provide an example for a distributed system you are familiar with.

(5 marks)

b) With reference to a **Distributed Application** explain the term **load balancing** and its functionality. Give an example of an application which may use load balancing and illustrate your answer with a diagram.

(10 marks)

c) What is concurrency in a distributed system? Explain your answer referring to the **TWO** models for building concurrent systems.

(10 marks)

A2.

a) What is a **Web Service**?

(5 marks)

b) Define the concept of **Service Oriented Architecture** (SOA) and explain the following principles: Standardized Service Contract, Loose Coupling, Service Abstraction, Service Reusability.

(14 marks)

c) With reference to electronic mail, what are IMAP and POP and what is the main difference in their functionality?

(6 marks)

[Turn Over]

Section B
Answer Section B questions in Answer Book B
For all questions illustrate your answers with diagrams where appropriate

B3.

a) Describe the concept of a cryptographic hash function and explain why it should show both pre-image resistance and collision resistance.

(7 marks)

b) In **Public Key Cryptography**, what is meant by key asymmetry?

(4 marks)

c) Explain the purpose of a digital signature and how digital certification is achieved. It is not necessary to write out the entire content of a digital signature, but your answer should include explanations of the use of a hash function, public key cryptography and a certificate authority (CA) to achieve its purpose.

(7 marks)

d) In electronic payment services, why might public key cryptography not be good enough on its own, and how might public key cryptography be coupled with symmetric encryption to provide the required data privacy?

(7 marks)

B4.

a) What are the benefits of a packet switched network over a message switched network that have led to its universal use in the packet switched Internet?

(9 marks)

b) In what scenarios are circuit switched networks able to offer superior performance to packet switched networks? Explain your answer with reference to the benefits of circuit switching.

(6 marks)

c) In what way are traditional circuit switched networks able to be provided by packet switched networks? What are the advantages and disadvantages of doing so?

(5 marks)

d) Consider and explain how Digital Subscriber Loop (DSL) connections to a property are provided, and whether these are packet switched, circuit switched or both.

(5 marks)

[Turn Over]

B5.

a) TCP connections implement congestion control through a mechanism known as slow start. Describe the slow start congestion control mechanism.

(8 marks)

b) The TCP Reno version added a mechanism known as Fast Retransmit and Recovery. Describe the algorithm used to implement this, explaining what is meant both by Fast Retransmit and Fast Recovery.

(8 marks)

c) Evaluate the core assumption of slow start that could lead to poor performance in some cases and describe at least **ONE** type of network where the mechanism would produce sub optimal throughput.

(4 marks)

d) By default, early web servers required a new TCP connection for each resource accessed by the web client, with the connection being closed by the server when the resource was delivered. The HTTP 1.1 protocol changed the default to a persistent connection, so that single TCP connections are now able to deliver multiple resources before timing out after a period of inactivity. Consider and explain why this should offer a significant improvement of performance when delivering a web page that has multiple graphical page elements.

(5 marks)

END OF EXAMINATION