

BCS THE CHARTERED INSTITUTE FOR IT

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

NETWORK INFORMATION SYSTEMS

Monday 15th April 2024 - 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

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

- A1.**
a) The structure of the TCP/IP stack is given on **Figure A1a**.

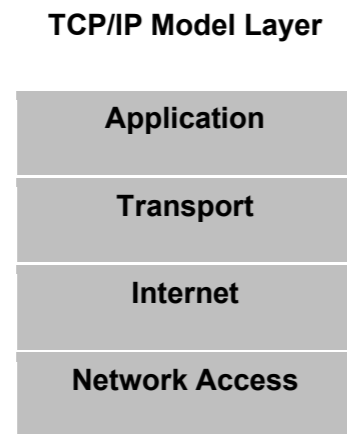


Figure A1a

Explain the purpose of each layer and its correspondence to the standard ISO OSI 7-layer network model.

(13 marks)

- b) Using the diagram shown in Figure A1b as reference, explain the concept of “packet burst” in TCP and indicate how TCP controls it through the “window” value.

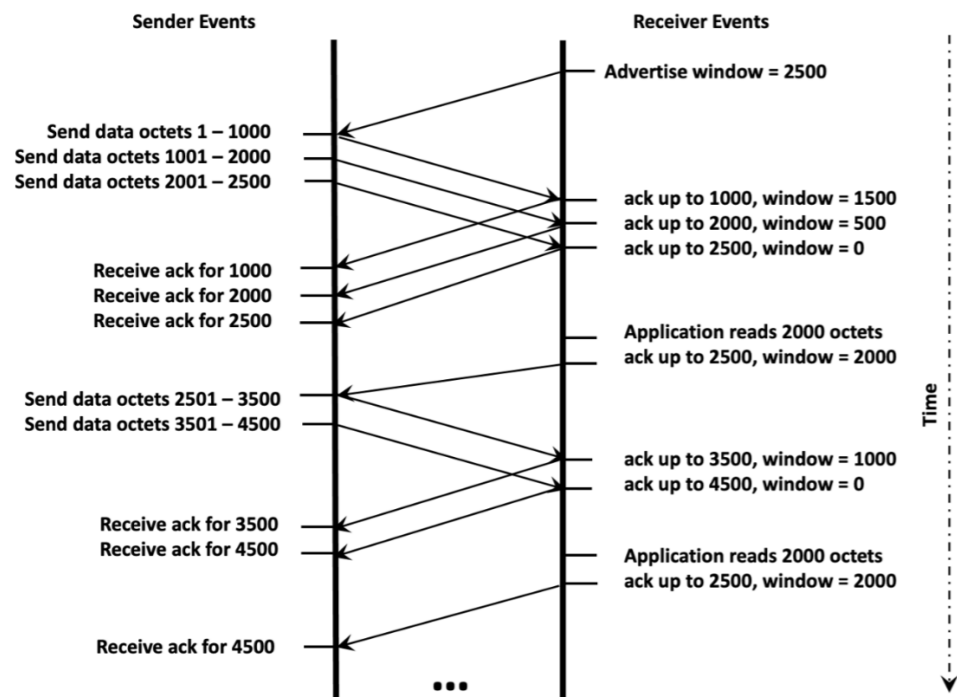


Figure A1b

(6 marks)

- c) Assume that the time between packets sent in a burst is 1 millisecond and the round-trip time of a packet is 10 milliseconds.

Transmission time of the packet is not to be considered.

Calculate the time saved when five packets are sent in a burst and an acknowledgement is received compared to sending each of the five packets separately and receive an acknowledgement for each.

(6 marks)

A2.

- a) In terms of computer networks and the OSI model, define the concept of bridging and indicate at what OSI Layer it occurs.

(3 marks)

- b) In IPv4 the link between addressing at the OSI Layer 2 and the OSI Layer 3 is the Address Resolution Protocol (ARP).

Explain the purpose of ARP and the steps followed by the protocol to achieve its purpose.

(9 marks)

- c) IPv6 is the next version of IPv4 and many of the protocols used in IPv4 have a counterpart in IPv6.

- i. Name the counterpart protocol of ARP in IPv6 and explain briefly how it works.

(4 marks)

- ii. Indicate the type of IPv6 addresses, i.e., Unicast, Multicast or Anycast, that replaces broadcast IPv4 addresses in IPv6 and describe its characteristics.

(3 marks)

- d) One of the following two IPv6 addresses is invalid. Identify which one is invalid and describe how it can be made a valid IPv6 address.

- 2031:0:130F::9C0:876A:130B
- 2001:0DB8:0000:130F:0000:0000:08GC:140B

(6 marks)

[Turn Over]

Section B
Answer Section B questions in Answer Book B

B3.

The domain name system (DNS) is a large hierarchical distributed system that acts as a directory service for the Internet, allowing the look up of domain names, IP addresses and some other information.

- a) Describe, with the aid of a diagram if necessary, the structure of the DNS and explain how information may be located within the directory from local and remote nodes. Include in your answer a short description of what is meant by a zone of authority. **(10 marks)**
- b) Indicate in what ways the DNS prioritises availability over consistency. **(7 marks)**
- c) Explain the CAP theorem with reference to the DNS. **(8 marks)**

B4.

- a) Describe the **FOUR** main causes of end-to-end delay in a typical wide area network. **(8 marks)**
- b) Explain what additional cause of delay affects round trip time (RTT). **(4 marks)**
- c) The capacity of a network is defined as the bandwidth multiplied by the latency. Using a large file transfer as an example:
 - i. Explain why a high latency leads to a high network capacity. **(4 marks)**
 - ii. What impact this has on the data transfer? **(4 marks)**
 - iii. What strategy can be used to utilise this high capacity? Explain the role of flow control in your answer. **(5 marks)**

B5.

The General Data Protection Regulation (GDPR) imposes seven data protection principles, the sixth being:

“Integrity and confidentiality — Processing must be done in such a way as to ensure appropriate security, integrity, and confidentiality”.

- a) Explain what is meant by symmetric encryption, and how this may be used to maintain confidentiality of data on a network. **(5 marks)**
- b) What is asymmetric encryption? Describe how it differs from symmetric encryption. **(6 marks)**
- c) What is meant by a hash function? In your answer, describe how a hash function may be used with asymmetric encryption to provide data integrity rather than confidentiality. **(7 marks)**
- d) Explain briefly, with the aid of diagrams if appropriate, how transport layer security (TLS) uses a combination of asymmetric and symmetric encryption to provide both confidentiality and data integrity, as well as authentication over a network connection between two nodes. **(7 marks)**

END OF EXAMINATION