

BCS THE CHARTERED INSTITUTE FOR IT

BCS HIGHER EDUCATION QUALIFICATIONS
BCS Level 5 Diploma in IT

COMPUTER NETWORKS

Monday 27th March 2017 – Afternoon

Answer **any** FOUR questions out of SIX. All questions carry equal marks
Time: TWO 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.

Only non-programmable calculators are allowed in this examination.

Section A
Answer Section A questions in Answer Book A

- A1.** This question is about fibre optic transmission systems.
- a) Explain how data is transmitted along a fibre optic cable and indicate at least three advantages fibre optic cable has over copper cable. **(12 marks)**
 - b) Briefly explain how wave division multiplexing (WDM) is able to increase the amount of data that can be transmitted along a single fibre optic cable. **(6 marks)**
 - c) A fibre optic transmission system uses wave division multiplexing with eight different wavelengths of light. Each of these wavelengths is able to operate at 1Gbps. If it requires 32,000 bps to transmit an uncompressed telephone call, determine approximately the maximum number of telephone calls that can be transmitted at the same time using this fibre optic cable. **(7 marks)**
- A2.** This question is about the Transmission Control Protocol (TCP) and User Datagram Protocol (UDP).
- a) Explain how a network connection is established between a user and a server over the Internet using the TCP protocol. **(8 marks)**
 - b) Both the TCP and UDP protocols use port numbers. What are these port numbers used for and what is meant by the term **well-known port**? Give an example of a well-known port. **(6 marks)**
 - c) What is the difference in the quality of service (QoS) offered to applications by the TCP and UDP protocols? **(8 marks)**
 - d) For each of the following three applications, state whether you would use TCP or UDP.
 - i. file transfer
 - ii. video streaming
 - iii. an audio conference.**(3 marks)**

- A3. Infotronics is a private college that provides part-time and full-time courses in IT and business. It is planning to move to a new site and is considering the networking that should be installed. The site consists of three buildings. The Grace Hopper Building contains a dedicated computer room with a number of high performance dedicated servers. The servers provide services to students and staff who may access them either over the Internet or over the College's own internal network. The Maurice Wilkes Building B contains the staff offices, for both lecturers and administrative staff. They have desktop computers on fixed desks, from which they need access to the Internet and to other College servers. The Hopper Building and the Wilkes Building are linked by an underground duct. The Alan Turing Building C contains a reception desk, lecture rooms and a café. There is no duct linking it to the other buildings. The lecture rooms have a desktop computer at the front for use by the lecturers, but some lecturers prefer to use their own laptop or tablet computer. All the students use laptop or tablet computers to take notes and keep in touch with their friends.
- What type of network should be deployed in the Grace Hopper Building and what equipment should be installed? **(5 marks)**
 - What type of network should be deployed in the Maurice Wilkes Building and what equipment should be installed? **(5 marks)**
 - What type of network should be deployed in the Turing building and what equipment should be installed? **(5 marks)**
 - What type of network connections should be used to link the buildings together and where and how should the College's Internet connection be made? **(10 marks)**

Section B

Answer Section B questions in Answer Book B

- B4. This question is about error detection and correction in data communication.
- Explain in outline how the Hamming (7,4) code works and what its error detection and correction capabilities are. **(6 marks)**
 - Two communicating devices are using a single-bit even parity check for error detection. The transmitter sends the byte 10101010 and, because of the channel noise, the receiver gets the byte 10011010. Indicate, with a brief explanation, whether or not the receiver will detect the error. **(4 marks)**
 - Calculate the Hamming distances among the following codewords and give the minimum distance for each of the two sets.: **(11 marks)**
 - 00000, 10101, 01010
 - 000000, 010101, 101010, 1101110
 - The Cyclic Redundancy Check (CRC) algorithm is widely used for error detection in data communications. Given the message 110100111 and the polynomial 1011, indicate how many bits will be padded into the message to prepare it for transmission and express the polynomial algebraically. **(4 marks)**

B5. This question is about the network layer and its functionality.

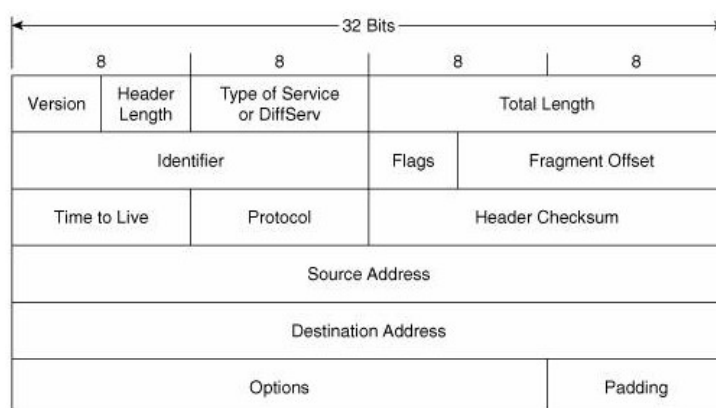
a) The network layer, or OSI layer 3, provides services to allow end devices to exchange data across the network. To accomplish this end-to-end transport, the network layer uses four basic processes: addressing of end devices, encapsulation, routing and de-encapsulation. Briefly describe the purpose of each of those basic processes. **(8 marks)**

b) The IP protocol is said to be:

- i. connectionless,
- ii. best effort, *and*
- iii. media independent.

Briefly indicate what is meant by each of these terms. **(6 marks)**

c) The image below depicts the format of the IP header. Briefly indicate the purpose of the following IPv4 header fields: (i) version, (ii) differentiated services, (iii) time-to-live, (iv) protocol, (v) source IP address, and (vi) destination IP address. **(6 marks)**



d) Indicate five advantages of IPv6 against IPv4. **(5 marks)**

B6. This question is about the quality of service (QoS) provided by a communication network.

a) The following terms relate to the quality of service provided by a network:

- | | |
|-------------------------|-----------------------|
| (1) Code delay | (2) Propagation delay |
| (3) Packet loss | (4) Jitter |
| (5) Queue | (6) Bandwidth |
| (7) Serialization delay | (8) Congestion |

The following are descriptions or definitions of the terms (in a different order)

- (A) This happens when congestion occurs
- (B) The fixed amount of time it takes to transmit a frame from the NIC (Network Interface Controller) to the wire
- (C) Holds packets in memory until resources become available to transmit them
- (D) The number of bits that can be transmitted in a single second
- (E) The fixed amount of time it takes to compress data at the source before transmitting to the first internetworking device
- (F) When the demand for bandwidth exceeds the amount available
- (G) Caused by variations in delay

(H) The variable amount of time it takes for the frame to traverse the links between the source and destination

For each term, write down the description or definition that most closely matches it, e.g. (9) – (Z). **(8 marks)**

b) For each of the following traffic characteristics, state whether it applies to video traffic, voice traffic or data traffic. **(7 marks)**

- i. Can be very greedy, consuming a large portion of network capacity.
- ii. Without adequate QoS and sufficient bandwidth, this traffic typically degrades.
- iii. Cannot be retransmitted if lost.
- iv. Traffic can be predictable and smooth.
- v. Does not consume a lot of network resources.
- vi. Traffic can be smooth or bursty.
- vii. Very sensitive to delays and dropped packets.

c) Explain the purpose of a Service Level Agreement (SLA) and describe briefly four items that it should cover. **(10 marks)**