BCS THE CHARTERED INSTITUTE FOR IT

BCS HIGHER EDUCATION QUALIFICATIONS
BCS Level 5 Diploma in IT

COMPUTER NETWORKS

Monday 30th March 2015 - 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.   **(6 marks)**

   b) Identify three physical characteristics of fibre optic cables that make them more suitable for high speed digital data transmission than copper cables.   **(6 marks)**

   c) Describe what is meant by *wave division multiplexing* (WDM) and explain how it is used to deliver high rate data transmission over a fibre optic cable.   **(6 marks)**

   d) A fibre optic transmission system uses wave division multiplexing with 16 different wavelengths of light. Each of these wavelengths is able to operate at 2.5Gbps. What is the maximum data carrying capacity of this transmission system?   If you require 4Mbps to stream one high definition video, determine how many such videos could be transmitted at the same time using this fibre optic transmission system.
      (7 marks)

A2. This question is about the ISO Reference Model.

   a) The ISO Reference Model defines seven protocol layers, each of which is responsible for a specific range of functions.   By considering this model, explain the main functions performed by a protocol operating at:

      (i) The Physical layer   **(3 marks)**
      (ii) The Transport layer   **(3 marks)**

   b) What is meant by the term peer to peer protocol?   **(3 marks)**

c) Give one example of a device on a network that is required to operate all seven layers of the OSI Reference Model. **(2 marks)**

d) Figure 1 shows part of a network in which two personal computers A and B, are each connected to a switch (LAN switch 1 and 2) which are themselves interconnected by a router. Consider the transmission of data from personal computer A to B and produce a protocol layer diagram that clearly shows how data passes through all of the layers of the ISO Reference model that are used within the PCs, switches and router. **(14 marks)**
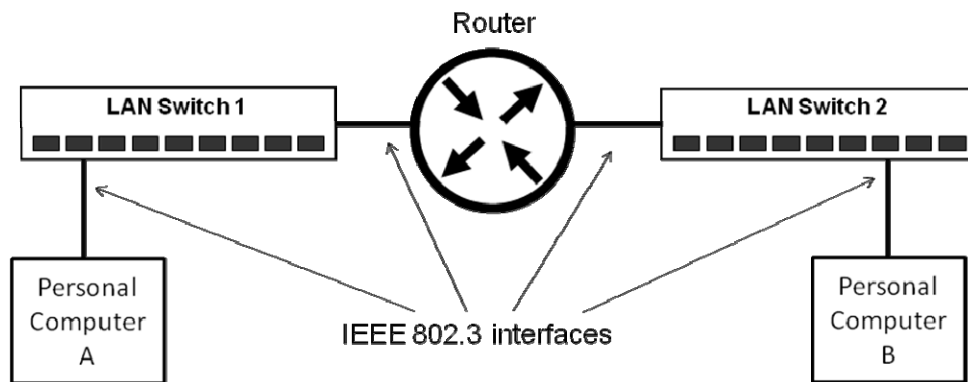

Figure 1

A3. This question is about global network services and specifically a comparison between the Internet and Multi-protocol label switching (MPLS).

a) A global organisation has offices located in different countries around the world and wishes to connect these together with a network that can transfer data and telephone calls between each office. Explain how the Internet could be used to provide this network. **(4 Marks)**

b) What limitations in terms of the Quality of Service it offers does the Internet have in respect of providing the network described in part A3a)? **(6 Marks)**

c) How does the Quality of Service offered by Multi-protocol label switching (MPLS) differ from that offered by the Internet? **(6 Marks)**

d) How could the global organisation described in part A3a) use Multi-protocol label switching (MPLS) to create its network and explain how MPLS would be able to provide a different Quality of Service for the transfer of data and telephone calls. **(9 Marks)**

Section B

Answer Section B questions in Answer Book B

B4. This question is about the main differences between IPv4 and IPv6.

a) IPv6 introduced the concepts of global unicast and link local addresses. Provide a brief description of the differences between those addresses. **(6 marks)**

b) Explain the reason why IPv6 addresses are represented in hexadecimal while IPv4 in binary. **(4 marks)**

c) Write the shortest compressed format of the following IPv6 addresses:

- 2001:0DB8:0000:1470:0000:0000:0000:0200 **(4 marks)**

- F380:0000:0000:0000:0123:4567:89AB:CDEF **(3 marks)**

d) The dynamic assignation of Global Unicast IPv6 addresses can be done in two different ways: 1) Stateless Address Autoconfiguration (SLAAC) and, 2) Dynamic Host Configuration Protocol v6 (DHCPv6). Describe the differences between the two methods. **(8 marks)**

B5. This question concerns local area networks (LAN) technology and IEEE802.3 standards.

a) The data link layer in the IEEE standard is divided into two sublayers: LLC and MAC. Indicate the functions performed by each sublayer. **(5 marks)**

b) Draw the flow diagram of the Carrier Sense Multiple Access/Collision Detection mechanism used by Ethernet (CSMA/CD). **(6 marks)**

c) Explain the reason why CSMA/CD requires a restriction on frame size for it to work. **(4 marks)**

d) Use the following image to indicate the format of the IEEE 802.3. **(7 marks)**

2 bytes	1 byte	6 bytes	6 bytes	2 bytes		4 bytes
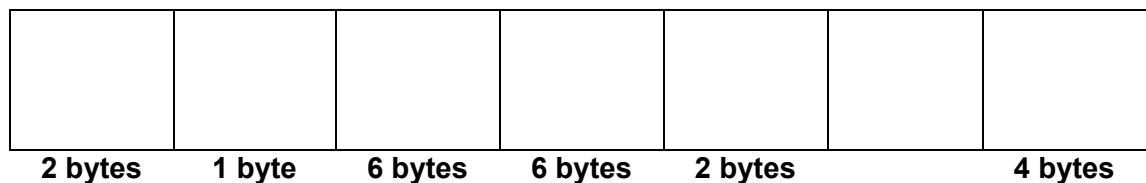
e) Explain the purpose of the length/type, Data and CRC fields of the IEEE 802.3 frame. **(3 marks)**

B6. This question is about error detection and correction.

a) Explain the concept of Hamming distance and how it is calculated. **(4 marks)**

b) Explain the relationship between the Hamming distance and errors occurring during transmission and calculate the Hamming distance between 01011 and 10101. **(6 marks)**

c) Indicate and explain what would be the minimum Hamming distance for error detection and the minimum for error detection. **(10 marks)**

d) A code scheme has a **Hamming distance d_{min} = 4**. What is the error detection and correction capability of this scheme? **(5 marks)**