

BCS THE CHARTERED INSTITUTE FOR IT

BCS HIGHER EDUCATION QUALIFICATIONS
BCS Level 5 Diploma in IT

COMPUTER NETWORKS

Thursday 3rd April 2014 - 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 physical layer transmission systems.

- a) A digital transmission system uses a coding scheme that defines a symbol as a voltage that can have one of eight possible values. If the system operates at a transmission rate of 1,000 symbols per second, determine the data transmission rate measured in:
- i. Baud (2 marks)
 - ii. Bits per second (4 marks)
- b) Wide Area Network (WAN) encapsulation protocols are used when connecting a router to an externally provided WAN service. These protocols are based on the High Level Data Link Control (HDLC) in which each message starts and ends with the unique flag sequence of 01111110. In order to prevent this flag sequence from occurring at other parts of the message, a process known as zero bit insertion, or bit stuffing is used. By considering the transmission of the following 5 message data bytes show how zero bit insertion is used when transmitting this message.
- 01111010 11111001 11111010 01111110 01101100 (8 marks)
- c) Identify three physical characteristics of fibre optic cable that make it more suitable for high speed digital transmission than copper cables. (6 marks)
- d) Describe what is meant by *wave division multiplexing* (WDM) and explain how it is able to deliver high rate data transmission over a fibre optic cable. (5 marks)

Turn Over]

A2. This question is about protocol layers and the OSI Reference Model.

- a) The OSI 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
- ii. The Data Link layer
- iii. The Application layer

(9 marks = 3 x 3 marks)

- b) Figure 1 shows a small scale network comprising a computer, switch, router and server. Examine this network and determine the following:

- i. which layers of the OSI Reference Model are used within the router
- ii. which layers of the OSI reference Model are used within the switch
- iii. which devices will use all seven layers of the OSI Reference Model
- iv. which devices will use layer 4 of the ISO Reference Model

(9 Marks)

- c) Referring again to Figure 1. By considering either the computer or server, produce a diagram of the OSI Reference Model that clearly shows how data is transferred through the model's layers.

(7 Marks)

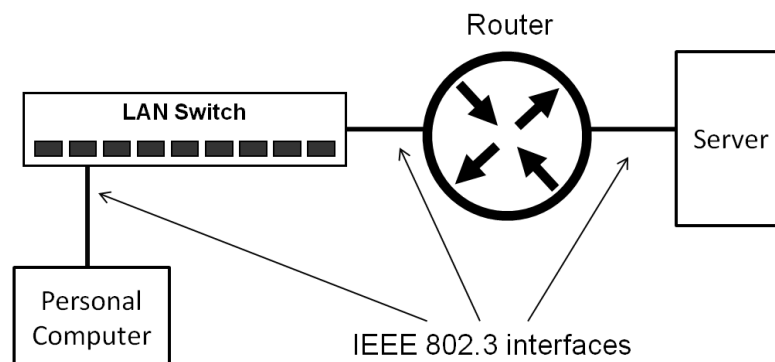


Figure 1

Turn Over]

A3. Asynchronous Transfer Mode (ATM) has seen widespread adoption within the Universal Mobile Telecommunication System, 3rd generation mobile phone networks. This question is about the features and operation of ATM.

- a) Show by means of a diagram, the cell format using within an ATM network. **(5 marks)**
- b) What is the difference between a Virtual Path and a Virtual Channel? **(5 marks)**
- c) Explain the purpose and function of the ATM Adaptation Layer (AAL) protocol. **(9 marks)**
- d) A UMTS, 3rd generation mobile network, uses AAL2 for the circuit switched voice traffic and AAL5 for the transmission of data. Why are these two different AAL protocols needed? **(6 marks)**

Section B

Answer Section B questions in Answer Book B

B4. The question is about the provision of Quality of Service (QoS) within the Internet.

- a) The Internet is often described as only offering a “best effort” service. What do people mean by describing it this way?
(5 marks)
- b) Identify one application where a “best effort” service is not good enough; clearly explain your reasons.
(5 marks)
- c) Why is it impossible for a router to provide an enhanced level of QoS to all traffic moving via it?
(5 marks)
- d) What features must exist within a router, and how must a router use those features if it is to provide different levels of QoS to different types of traffic?
(10 marks)

B5. The question is about the behaviour of Internet routers. At a simple level, routers conduct two tasks. They create routing tables and they forward individual packets.

- a) What are the main priorities for a router when it is attempting to forward individual packets?
(5 marks)
- b) Routers sometimes learn about connectivity within the networks of a small organisation using distance vector protocols. Describe the general behaviour of distance vector protocols illustrating your answer by reference to Routing Information Protocol (RIP).
(10 marks)
- c) RIPv1 ceased to be sufficient as the Internet and its constituent networks evolved. Explain the restrictions of RIPv1 and how RIPv2 solved some of the problems also noting which problems still remain.
(10 marks)

B6. This question is about error control in communications systems.

- a) Briefly explain the difference between single-bit errors and burst errors.
(3 marks)
- b) Imagine that a noise event causes a burst error to occur that lasts for 1 ms (milli second).
 - i. If data is being transmitted at 10Mbps. If how many data bits will be affected?
(3 marks)
 - ii. If data is being transmitted at 100Mbps. If how many data bits will be affected?
(3 marks)

Turn Over]

- c) Under what circumstances is the use of parity bits is an appropriate error control technique?
(3 marks)
- d) Explain the meaning of the term “residual error rate” in the context of error detection schemes.
(3 marks)
- e) Under what circumstances is the use of cyclic redundancy counts (CRC) an appropriate error control technique?
(3 marks)
- f) Very briefly outline how the CRC method functions.
(7 marks)