THE BCS PROFESSIONAL EXAMINATION
Diploma

October 2004

EXAMINERS' REPORT

Computer Networks

General

The pass rate has increased this year appreciably from 60% in April 2004 to 69% in October 2004. This can be partly attributed to the interest and knowledge shown in the answers in respect of questions 5 and 6, which a majority of students answered. Also, the answers given to question 1 were generally good. The increase in the pass rate and the interest shown in the new areas of wireless networking and internet is very encouraging.

Question 1

1. With reference to IP addressing, explain how you could determine whether an address is a Class A, B or C address. (5 marks)

a) What is the purpose of a subnet mask? Show how it works with the aid of a diagram. (8 marks)

b) Your organisation has been assigned the Class C address of 200.127.12.0 and your network administrator has assigned the subnet mask of 255.255.255.224.

i) How many sub-networks can you have on this network? Clearly show how you obtained your answer. (6 marks)

ii) How many nodes can be supported on each of these sub-networks? Again, clearly show how you obtained your answer. (6 marks)

Examiners' Comments

The parts to the answer were given differently on the question paper and the marking scheme. On the marking scheme the parts are called (a), (b) and (c). On the question paper the first part lacks a letter, and the second and third parts are called (a) and (b). Here I am following the lettering on the marking scheme.

The students generally scored well on this question.

For part (a) the marking scheme gave 2 marks for the general IP address format. Since this was not explicitly asked for in the question, I did not deduct marks for not giving this. Most students did give it anyway.
If they got the general address format but failed to get the other part of this question correct, I gave the 2 marks indicated for the general format.

In part (b) many students gave the answer to the purpose of the subnet mask in the sense anticipated by the marking scheme. Some gave satisfactory answers in a different way. If they said that the purpose of the subnet mask was to subdivide a network, for instance, I gave the 2 marks allocated for explaining the purpose of the subnet mask. On the other hand, some of the explanations given of the purpose of the subnet mask were not at all clear and did not attract the marks. A lot of students thought that the purpose of the subnet mask was to save IP addresses, whereas, when it is used to subdivide a network addresses are lost (the all ones and all zeros addresses within the subnets).

Part (c) was done very well on the whole, and that is an important part of the reason why the students did well, overall, on this question. A lot of students did the entire question correctly, finding the right boundary

within the last octet between the ones and zeros and also calculating the number of subnets and hosts correctly.
The marking scheme allowed – correctly – for 32 or 30 as the number of hosts. For the number of sub-networks it gives 8. It is also possible for the answer to be 6 (deducting 2 as is done for the number of hosts). So I marked 6 correct as well (a lot of students gave this). I am aware that more sophisticated software will allow 8 subnets, but many books (e.g. Comer, 4th edition) give 6 as the answer, so it can hardly be marked wrong.

Question 2

2. *a)* Explain what is meant by the term *protocol layering*. (6 marks)

b) By means of a protocol layer diagram show how data can be transferred between two end-stations, clearly illustrating how data passes through protocol layers and what is meant by the term *peer to peer* protocol. (8 marks)

c) With reference to the ISO 7 layer Reference Model, explain what functions are performed by the Data-Link layer. (5 marks)

d) What function is performed by the IEEE 802 LLC and MAC layers? Show how these relate to the ISO 7 layer Reference Model. (6 marks)

Examiners' Comments
In part (a) most students got marks for indicating that protocol layering involves dividing a system into a series of smaller components, or layers. Some, but not so many, also addressed the relation between the layers.

In part (b) most students who drew the diagram showed either the vertical flow of data or the horizontal peer to peer concept. Fewer students managed both. It they gave a very developed answer to just one part of the question, I gave them a couple of extra marks.

Quite a large number of students responded to the requirement to explain what 'peer to peer' protocol means by referring to the idea of two computers being directly linked together. This is wrong, of course. Also some gave the answer that 'peer to peer' is to be understood in the sense that we speak of peer to peer networking when there is no hierarchy between the computers (as in a Microsoft work group, for instance). Although this is not entirely unreasonable, it does not relate to the context of the question, and I did not give marks for it.

The students, on the whole, scored quite well in part (c) and (d). Since these parts asked the student to list various functions, the structure of the question allowed them a good opportunity for putting down something relevant under one or more headings. They also, by and large, scored quite well on mapping the MAC and LLC functions to the data link layer in the ISO model.

Question 3

3. *a)* Describe how a communications protocol is able to guarantee the delivery of data through a network by adopting a 'sliding window' packet acknowledgement system. (9 marks)

b) What is meant by the term *flow control* and show how this can be achieved by a communications protocol? (8 marks)

c) Explain how TCP is able to guarantee the transfer of data across a network. (8 marks)

Examiners' Comments

Overall, in this question, students did not score very highly. The question is quite wide ranging and, if they got one part right, they often fell down in trying to explain some other concept in another part of the question. On the other hand, they got a fair number of opportunities to find something they could explain, so they usually scored some marks somewhere along the line.

In part (a) not many students explicitly noted the point that each PDU had to be uniquely numbered. Most scored the mark for mentioning that frames have to be acknowledged. In terms of the purpose of the window, the explanations were not always very clear, but the fact that it allows several frames to be sent at once usually came up somewhere in the answer. Some students thought that the 'sliding' in the sliding window was to do with the changes that can take place in the window size, over time. While this is an understandable confusion, it is unfortunately wrong. A fair number of the students got the diagram right, or else gave a clear verbal explanation of the sliding of the window along the list of PDUs.

The most striking thing in part (b) was the number of students who thought that the purpose of flow control was to ensure that data arrived correctly through the use of acknowledgements. If this was said explicitly it was at least clear what they thought. In many cases it was not very easy to interpret what they did think was the purpose of flow control. But some students did answer clearly on that. Not very many referred to the idea of a STOP command or a resume message, as indicated in the marking scheme.

The question of part (c) was quite open in its formulation so that there were many points that students could make to explain how TCP is able to guarantee the transfer of data across a network. For instance students explained that TCP establishes a connection, which is quite relevant although it happens not to be explicitly referred to in the example answer. Although the marks are divided into two lots of 4 – 4 for describing the general approach, 4 for providing an example to illustrate – I gave extra marks for the first part if the students had given a lot of points about the general approach.

Question 4

4. *a)* The integrated services digital network services is commonly supplied in a 2B+D interface. Explain the characteristics of the B and D channels. (12 marks)

b) Why is congestion control vital to the operation of ATM networks? Discuss the THREE types of strategies used in congestion control in ATM networks. (13 marks)

Examiners' Comments

Part a) Most students who chose this question explained characteristics of the B and D channels in an ISDN network with the right frequency of 64Kbps for voice or data in a B channel, and a 16Kbps in a D channel for signalling purposes, and that the use of this separate channel for fast call set-up time. The total available bit rate at the basic interface is thus 2B+D = 144 Kbps. The answer also requires a schematic outline showing a digital pipe of the two B and a D channel or a network interface /physical layer schematic outline. Explanation of the 144 Kbps fully digital link for use Internet was expected which some students drew attention to.

Part b) The congestion control discussion is about both the long term and the short term congestion control strategies, and to this end the discussion should be about i) preventing congestion occurring which is usually called admission control, ii) reserving enough bandwidth to handle any peak cell rate called the resource reservation and iii) use of resource management cell between the sender and the receiver called the rate-based congestion control. Except a very few who mentioned a form of sliding window protocol, almost no student gave the right answer. However there were some good discussions on the characteristic of the ATM and the need to handle congestion etc..

Question 5

5. *a)* What are the essential differences between a connection-oriented service and a connectionless service at the network layer level? (7 marks)

b) List and discuss the advantages and disadvantages of bridges relative to a repeater. (10 marks)

c) What is the domain name system (DNS)? Explain how the domain naming system operates when an e-mail message is sent to an address. (8 marks)

A good number of students chose to answer this question.

Part a) almost all discussed the characteristics of connected-oriented service or virtual circuit where the source and destination have a unique connection and the destination acknowledges the successful receipt of data segments and reliable data transfer etc.. The connectionless service is a datagram service where there is no virtual connection between the source and destination and there is no guarantee of data segments receipt by the destination.

Part b) Bridges are used at the data link layer and for concatenation of LANs and of spanning LANS etc.. Advantages are bridges filter both input and output traffic which ensures that only the right data segments are routed. Bridge performance can be monitored using such factors such as bit rate, filtering rate and forwarding rate need mentioning and outlining.

The IEEE 802.1 standard and the spanning tree algorithm- the power-up learning of addresses of the connected nodes, enabling back up routing when the primary route has problems etc.. Disadvantage is the effort required when the two LAN segments do not have the same data rate and a bridge is to be used. Repeaters operating at the physical layer amplify signals. Boost signal power, translate between two different media types, transmit to more than one network. But the disadvantage is in their inability to filter data and that they blindly send data frames.

Part c) DNS allows the user to employ symbolic names instead of IP addresses. In a domain naming structure organisations are grouped under primary domain names such as com (commercial), edu (education) etc.. and may also define where the host is located such as uk (United Kingdom). fr (France) etc.. The local domain name server should be able to map a domain name to an IP address. The e-mail path should be traced from the e-mail client to e-mail server, SMTP protocol operation, the DNS server operation etc.. Many students provided very good answers to this part of the question.

Question 6

6. *a)* What is client server computing? Discuss the features of client server architectures that use fat clients and thin clients. (10 marks)

b) Compile a list of capabilities and use it to explain the objectives that characterise the third generation wireless communication. (10 marks)

c) Explain the disadvantages of using wireless communication in networking applications. (5 marks)

Again a good number of students answered this question.

Part a) Most got the concept of the client-server computing right- a network of client machines and a central server and the central server providing required services to client machines and gave examples of such services as running printing services, access to peripherals etc.. A few students outlined the WWW services. The features of fat clients as machines with hard disks and having abilities to process data locally, and thin clients with minimal process abilities and sending data for processing at the server end were explained by almost all students. But only a few mentioned the heavy data traffic generated by fat clients, and the fact that a server breakdown would make a client-server computing in effectual in the case of thin clients. Almost no one mentioned the three-tier architecture which makes a client-server computing very effective.

Part b) The following features are identified in a 3G system:

- Enhanced multimedia : voice, data and video capabilities
- Functionalities include e-mail ,fax, videoconferencing, and Web browsing
- Higher broad bandwidth upto 2 Mbps
- Routing flexibility including satellite and roaming capability between regions.

Mention of UMTS (Universal Mobile Telecommunications Service) was expected and noone mentioned this. 3G wireless technology is meant to have enhanced role in homes, businesses, medical establishments and military etc.. 3G wireless technologies move the communication to include packet-based and broadband features to facilitate multimodal usage of handheld clients.

Part c). Despite the attraction of the wireless technologies, wireless communication has been limited by such factors as throughput, radio interference, path interference, weather and accidental damage etc.. Public safety issues surface very often when handheld mobile device applications are discussed.