UNIVERSITY OF COLOMBO, SRI LANKA

UNIVERSITY OF COLOMBO SCHOOL OF COMPUTING

DEGREE OF BACHELOR OF INFORMATION TECHNOLOGY (EXTERNAL)

Academic Year 2005/2006 – 2nd Year Examination – Semester 4

IT4102: Data Communication and Computer Networks

PART 2 – Structured Question Paper

5th August, 2006

(ONE AND A HALF HOURS)

To be completed by the candidate

BIT Examination Index No: .....

Important Instructions:

- The duration of the paper is **1 ½ (One and a Half) hours**.
- The medium of instruction and questions is English.
- This paper has **4 questions** and **16 pages**.
- **Answer question 1 (50** marks**) and any 2 of the other questions (25** marks each**) only**.
- **Write your answers** in English using the space provided **in this question paper**.
- Do not tear off any part of this answer book.
- Under no circumstances may this book, used or unused, be removed from the Examination Hall by a candidate.
- Note that questions appear on both sides of the paper.
  If a page is not printed, please inform the supervisor immediately.

Questions Answered

Indicate by a cross (×), (e.g. [X]) the numbers of the questions answered.

To be completed by the candidate by marking a cross (×).	1	2	3	4	
To be completed by the examiners:					

Index No: ……...

1) (a) The following bit stream is transmitted over a digital channel.

01001110010……..

The left most bit is sent first. Plot the voltage-time diagrams which correspond to the following encodings.

(i) NRZ-binary

(5 marks)

ANSWER IN THIS BOX

(ii) RTZ-binary

(5 marks)

ANSWER IN THIS BOX

(iii) Differential Manchester

(5 marks)

ANSWER IN THIS BOX

(b) (i) State Shannon's capacity theorem for noisy channels.

(5marks)

ANSWER IN THIS BOX

(ii) The IEEE 802.11g WLAN standard supports a maximum data rate of 54Mbps. If the signal to noise ratio of the radio channel is 20dB, calculate the bandwidth occupied by the WLAN system.

(8marks)

ANSWER IN THIS BOX

(c) The table below shows several LAN media access techniques used in practice.

(10 marks)

ANSWER IN THIS BOX

MAC Method	Technology Product (1)	Data/voice Support (2)	Performance (3)	Access Control (4)
Token passing				
CSMA/CD				
CSMA/CA				
CSMA/CA with polling				
TDMA				

Column (1) – Ethernet, Token Ring/Bus, wireless LAN, wireless WAN, other
Column (2) – data only, voice only, data+voice
Column (3) – good at low loads, good at high loads, good at all levels of load
Column (4) – centralized, distributed

Fill in the blanks in each numbered column with appropriate terms chosen from the corresponding list.

(d) An organization is assigned the single IP address, 192.248.16.90 by an ISP. It connects to the ISP over a dedicated leased line. The organization wishes to provide web access to 100 machines on a LAN via a HTTP proxy server.

(i) State an IP address range that can be used by the organization for the machines on the LAN.

(04 marks)

ANSWER IN THIS BOX

(ii) Sketch a diagram showing the possible connectivity of the HTTP proxy, the LAN and the leased line connection to the ISP**.**

(08 marks)

ANSWER IN THIS BOX

2) (a) The IEEE 802.3 standard of the CSMA/CD protocol specifies a simple yet effective way to share the bandwidth of a channel among multiple hosts.

(i) What is the minimum allowable packet transmit duration on a network having a one way propagation delay of τ?

(02 marks)

ANSWER IN THIS BOX

(ii) Why is this limit of minimum packet length important?

(02 marks)

ANSWER IN THIS BOX

(iii) Given that the efficiency of a CSMA/CD channel is

$$\frac{1}{(1+5a)}$$ where,

$$a = \frac{\text{one way propagation delay}}{\text{packet transmit time}}$$

Calculate the lowest efficiency that a CSMA/CD channel can have.

(03 marks)

ANSWER IN THIS BOX

(iv) Calculate the minimum packet length permissible on a 100Mbps, 200m UTP Ethernet. Assume that the propagation delay in copper is $2x10^8$ m/s.

(03 marks)

ANSWER IN THIS BOX

(b) The packet capturing tool *tcpdump* running on a computer that is on an Ethernet Hub based LAN can capture packets which are not destined to itself. However, if an Ethernet Switch is used instead of the Hub, *tcpdump* cannot capture packets which are not destined to the machine it is running on. Explain why this is so.

(03 marks)

ANSWER IN THIS BOX

(c) Use the most suitable terms from the following list and fill in the blanks in the paragraph below.

(12 marks)

(a) Leased line	(j) packet	(r) 32B+2D
(b) RSVP	(k) Diff-serv	(s) 64kbps
(c) B-ISDN	(l) VoIP	(t) 128kbps
(d) ATM	(m) RTP	(u) circuit
(e) virtual circuit	(n) Int-serv	(v) delay
(f) datagram	(o) 2B+D	(w) error
(g) N-ISDN	(p) ICMP	
(h) ADSL	(q) 30B+2D	
(i) dial up		

There are two types of Integrated Services Networks that are becoming obsolete due to technological advances. They are the (i) and the B-ISDN. Here, the (i) is being replaced by last mile access methods such as the (ii) and the B-ISDN by IP based QoS mechanisms such as (iii) and (iv). In principle, (i) is of two types: basic rate (BRI) which has a channel allocation of (v) and, primary rate (PRI) with a channel allocation of (vi), where, B is a data pipe at (vii) and D is a signaling pipe at 64kbps. B-ISDN is also known as (viii) in the technology domain. Where as (i) is (ix) switched, B-ISDN is (x) switched. In the IP based (iii) alternative to B-ISDN, the TOS field of the IP header is used to classify and give priority service to (xi) sensitive traffic. In (iv), (xii) is used as a signaling mechanism to reserve bandwidth across routers prior to the traffic transmission.

ANSWER IN THIS BOX

(i) ……..	(ii) ……..	(iii) ……..
(iv) ……..	(v) ……..	(vi) ……..
(vii) ……..	(viii) ……..	(ix) ……..
(x) ……..	(xi) ……..	(xii) ……..

3) (a) (i) Show by using a simple diagram, the operation of the stop-and-wait flow control protocol between a data source and a receiver.

(02 marks)

ANSWER IN THIS BOX

(ii) Explain why stop-and-wait protocol is efficient for error detection and recovery.

(02 marks)

ANSWER IN THIS BOX

(iii) Explain why stop-and-wait protocol is inefficient in large propagation delay networks.

(02 marks)

ANSWER IN THIS BOX

(b) A data source and a receiver are connected by a communication link with a bandwidth of 2Mbps and a roundtrip propagation delay of 200 ms. Assume that the full bandwidth is available for the source and the receiver and that the packet length is 1000 bytes.

(i) What is the percentage utilization of the link bandwidth if stop-and-wait protocol is employed?

(03 marks)

ANSWER IN THIS BOX

(ii) If instead of the stop-and-wait protocol, sliding window flow control is used, how many unacknowledged packets would there be in transit at any given time, between the source and the receiver when the link is fully utilised?

(03 marks)

ANSWER IN THIS BOX

(d) Figure 2 shows a network scenario where three hosts A, B and C are on different subnets L1, L3 and L2 respectively. R1 and R2 are routers. The hosts will have respective interface addresses PHY_A, PHY_B and PHY_C and IP addresses IP_A, IP_B and IP_C.

Similarly the router R1 will have PHY_R1_L1, IP_R1_L1 on L1 and PHY_R1_L2, IP_R1_L2 on L2. Router R2 will have PHY_R2_L2, IP_R2_L2 on L2 and PHY_R2_L3, IP_R2_L3 on L3.

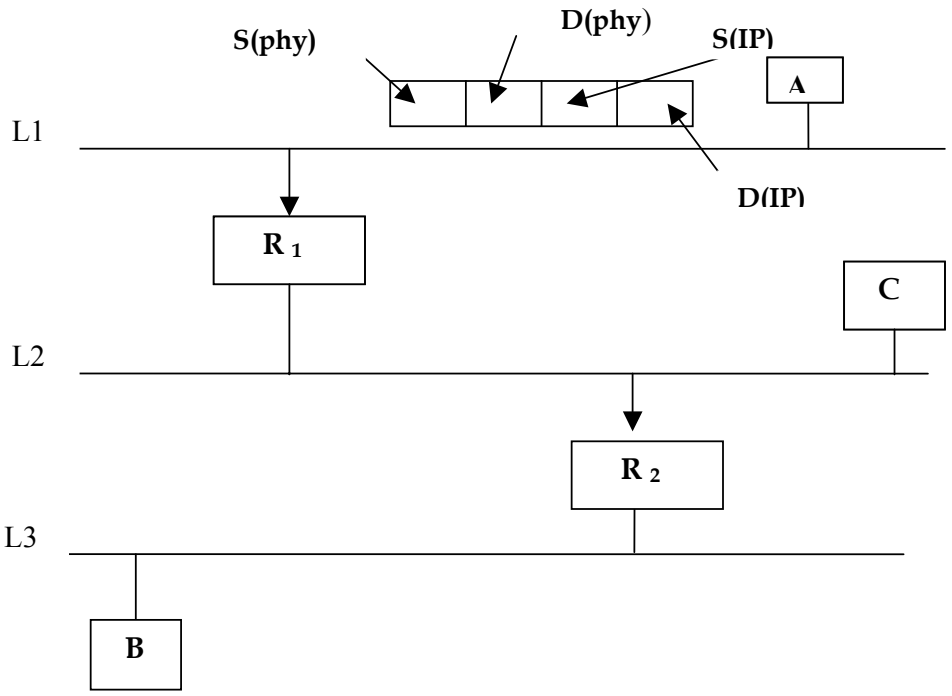

Figure 2

(i) Suppose A is sending a packet to B. Write down the correct values corresponding to the header fields, S(physical), D(physical), S(IP) and D(IP) for each of the packets seen on L1, L2 and L3.

(06 marks)

ANSWER IN THIS BOX

(ii) Redraw the same network scenario using Ethernet Switches and Hubs only.

(02 marks)

ANSWER IN THIS BOX

(iii) Suppose the hosts A, B and C are on different physical LANs, but A and B belong to the single logical user group and C belongs to a different user group. Which concept would you use in order to achieve this objective with the configuration of (ii) above?

(03 marks)

ANSWER IN THIS BOX

(iv) State two advantages of the configuration in (ii) over that of Figure 2.

(02 marks)

ANSWER IN THIS BOX

4) (a) An Internet application is to be programmed over a client-server socket connection, to be run on two machines connected to the Internet.

(i) What are the 5 parameters which define a *socket*?

(03 marks)

ANSWER IN THIS BOX

(ii) The client, when contacting the remote server, requires the destination application port number. What two general approaches are available to the client to find out the destination port number?

(02 marks)

ANSWER IN THIS BOX

(iii) State three BSD socket system calls available to the programmer to write his client-server application.

(03 marks)

ANSWER IN THIS BOX

Continued…

(iv) If the client-server application establishes a simple Telnet session, what is the simplest way to enhance it to a hypertext document transfer application between the machines?

(02 marks)

ANSWER IN THIS BOX

(b) A communications service provider (CSP) provides island wide network access by means of regional switches interconnected by high bandwidth microwave and WCDMA links. The last mile access to client sites is provided via a variety of means. Two companies having geographically distributed branches islandwide wish to utilize the communications infrastructure of the CSP to interconnect their branches.

(i) Show diagrammatically how this connectivity can be made. Assume that the CSP has four islandwide switches S1, S2, S3 and S4. Each of the three branches of Company_1 is connected to their nearest switches S1, S2 and S3 respectively as one branch to one switch. Similarly, each of the three branches of Company_2 is connected to their nearest switches S1, S2 and S4 respectively as one branch per switch.

(05 marks)

ANSWER IN THIS BOX

Continued…

(ii) What network design concept can be used to give each company the feel of its own network over the shared resources of the CSP?

(02 marks)

ANSWER IN THIS BOX

(iii) State two types of last mile access options available to the company branches?

(02 marks)

ANSWER IN THIS BOX

(c) Figure 3 shows a typical authentication handshake used in WLANs to identify the wireless node by the Access Point (Base Station).

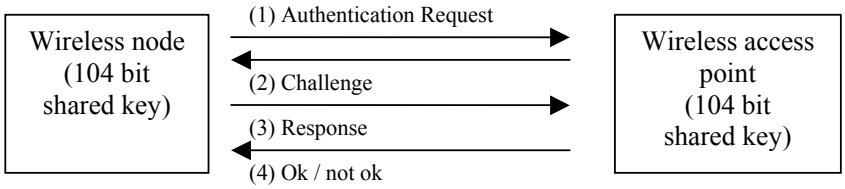

Figure 3

(i) Explain the details of the challenge and response steps involved.

(04 marks)

ANSWER IN THIS BOX

(ii) State two weaknesses in this type of mechanism.

(02 marks)

ANSWER IN THIS BOX

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