UNIVERSITI SAINS MALAYSIA

Second Semester Examination
Academic Session 2005/2006

April/May 2006

EEE 521 – COMPUTER AND DATA COMMUNICATIONS NETWORKS

Time: 3 Hours

INSTRUCTION TO CANDIDATE:

Please check that this examination paper contains **TEN** pages of printed material before you begin the examination.

Answer **FIVE** questions.

All questions must be answered in English.

...2/-

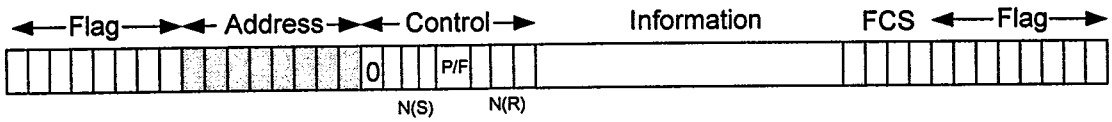
1. High Level Data Link Control (HDLC) is a data link layer protocol to provide reliable data transfer between two directly connected hosts. In order to detect transmission errors, the data is protected by a checksum.

(a) Given the bit sequence 110111110101 shall be transmitted. Compute the CRC checksum for this sequence by using the generator polynomial

$$G(x) = x^4 + x + 1$$

(5 marks)

(b) The HDLC frame structure for information frame (I-Frame) is given in Figure 1 below. Determine the bit patterns for the complete I-Frame if the primary is sending information frame 3 to the secondary host with address 11111111. The primary is confirming reception of frames 2, 3, 4 from the secondary. For the sake of simplicity, the poll/final (P/F) bit shall be neglected and set to 0 and the CRC checksum is based from the one in part (a) instead of the actual 16 bit checksum. Also, show that bit stuffing is applicable in this case.



N(S) = send sequence count
N(R) = expected frame number
P/F = poll / final bit

Figure 1: HDLC I-Frame

(10 marks)

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(c) The frame part b is now passed to the physical layer. Sketch the encoding of the frame's data part when using:

(i) Differential NRZ-Code
(ii) Manchester Code

(5 marks)

2. (a) Your organization has been assigned an IP network of 201.168.130.0. As a network engineer, you are to design your company's network with 6 departments having a separate subnetwork.

- Management subnet – 20 hosts
- Engineering subnet – 17 hosts
- Sales subnet – 23 hosts
- Maintenance subnet – 18 hosts
- Security subnet – 19 hosts
- Supervision subnet – 27 hosts

Obtain:

(i) Subnet address and subnet mask for each department
(ii) The range of IPs being used by each department.
(iii) The suitable network connection using several routers

(7 marks)

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(b) Given the following diagram of the spanning tree bridge network, determine which bridges would be used in forwarding packets?

(i)

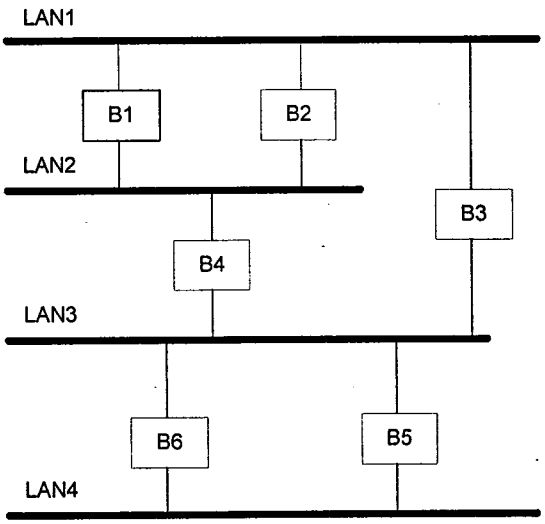

Figure 2 (b) (i) : Bridge Network

(ii)

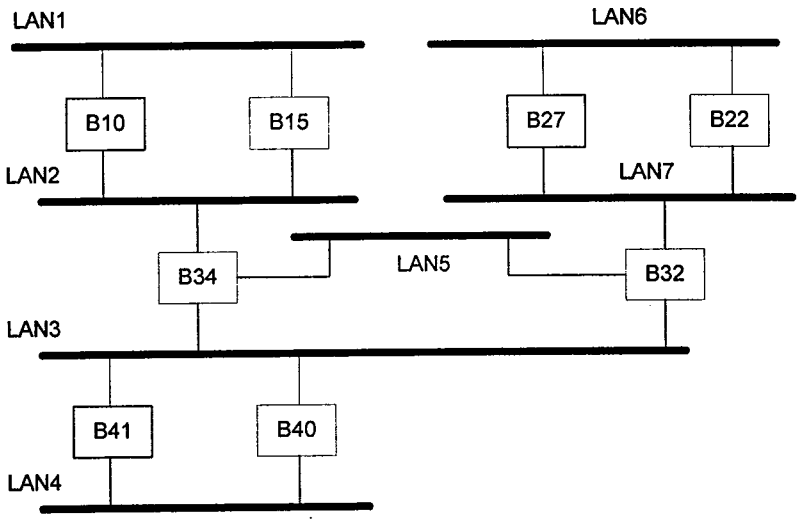

Figure 2 (b) (ii) : Bridge Network

(6 marks)

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(c) Reconfigure the following network into 4 subnetworks. Draw the appropriate network diagram using several routers along with the connected hosts and their range of IP address assignments.

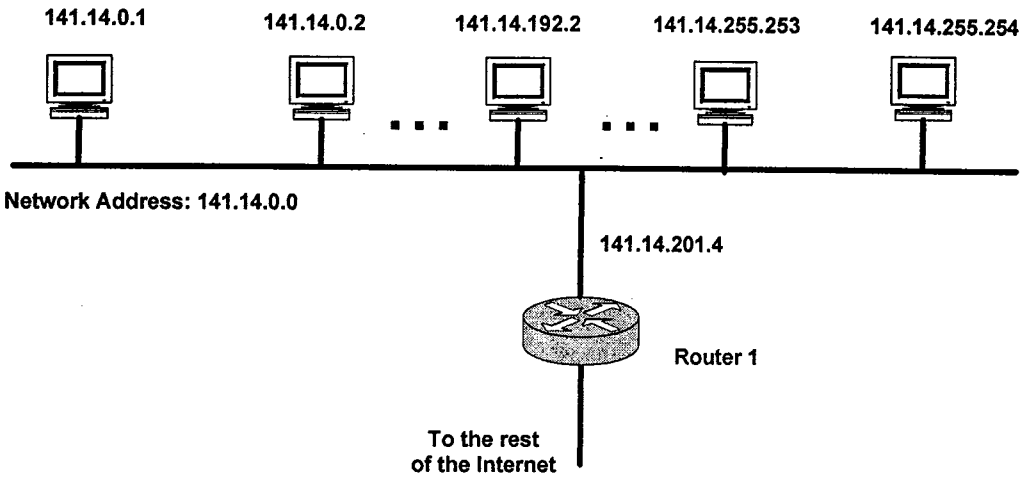

Figure 2(c) : Network Diagram

(7 marks)

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3. (a) Referring to the ASCI table below:

(i) Develop the ASCII code representation for the following text (ignore space).

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Kedudukan Bit			b_7	0	0	0	0	1	1	1	1
			b_6	0	0	1	1	0	0	1	1
			b_5	0	1	0	1	0	1	0	1
b_4	b_3	b_2	b_1								
0	0	0	0	NUL	DLE	SP	0	@	P	\	p
0	0	0	1	SOH	DC1	!	1	A	Q	a	q
0	0	1	0	STX	DC2	"	2	B	R	b	r
0	0	1	1	ETX	DC3	#	3	C	S	c	s
0	1	0	0	EOT	DC4	$	4	D	T	d	t
0	1	0	1	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	ACK	SYN	&	6	F	V	f	v
0	1	1	1	BEL	ETB	'	7	G	W	g	w
1	0	0	0	BS	CAN	(	8	H	X	h	x
1	0	0	1	HT	EM	)	9	I	Y	i	y
1	0	1	0	LF	SUB	*	:	J	Z	j	z
1	0	1	1	VT	ESC	+	;	K	[	k	{
1	1	0	0	FF	FX	,	<	L		l	|
1	1	0	1	CR	GS	-	=	M	]	m	}
1	1	1	0	SO	RS	.	>	N	>	n	~
1	1	1	1	SI	US	/		O	_	o	DEL

Figure 3 (a) : ASCII Table

(ii) Develop the Huffman coding scheme for the above text (ignore spaces). Show all your steps. Compare the efficiency of the Huffman coding scheme compared to the ASCII codes representation.

(7 marks)

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(b) Explain the following terms:

(i) Aloha

(ii) Carrier Sense Multiple Access (CSMA)

(6 marks)

(c) Compare and contrast the Selective Repeat ARQ with the Go Back N ARQ.

(7 marks)

4. (a) Show the ARP request and reply packets encapsulated in Ethernet frames for a communication from Host A to Host B on the same Ethernet network.

The format of an ARP packet is given below:

<table>
<tr><td colspan="2">Hardware Type</td><td>Protocol Type</td></tr>
<tr><td>Hardware Length</td><td>Protocol Length</td><td>Operation
Request 1, Reply 2</td></tr>
<tr><td colspan="3">Sender Hardware Address (For eg. 6 bytes for Ethernet)</td></tr>
<tr><td colspan="3">Sender Protocol Address (For eg. 4 bytes for IP)</td></tr>
<tr><td colspan="3">Target Hardware Address (For eg. 6 bytes for Ethernet)
(It is not filled in a request)</td></tr>
<tr><td colspan="3">Target Protocol Address (For eg. 4 bytes for IP)</td></tr>
</table>

(5 marks)

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(b) Explain the three strategies used in the transition from IPv4 to IPv6.

(7 marks)

(c) Show the initial and final routing tables for a small autonomous system of your choice using the RIP updating algorithm. Explain the working of the algorithm.

The RIP Updating Algorithm:
Receive: a response RIP message

(1) Add one hop to the hop count for each advertised destination.

(2) Repeat the following steps for each advertised destination :

(a) If(destination not in the routing table)

(i) Add the advertised information to the table.

(b) Else

(i) If(next-hop field is the same)

* replace entry in the table with the advertised one.

(ii) Else

* If (advertised hop count smaller than one in the table)

* Replace entry in the routing table.

(3) Return

(8 marks)

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5. (a) A router on an Ethernet network has received a multicast IP packet. When the host checks its multicast group table, it finds a match. Show how the router sends this packet to the recipients by encapsulating the IP packet in an Ethernet frame.

(6 marks)

(b) A client uses UDP to send data to a server. The data are 8 bytes. Calculate the efficiency of this transmission at the UDP level, IP level and at the data link layer. Assume no options for the IP header and use Ethernet at the data link layer.

(7 marks)

(c) An output interface in a switch is designed using the leaky bucket algorithm to send 4000 bytes/s. If the following frames are received in sequence, show the frames that are sent during each second.

Frames 1,2,3 : 3200 bytes each
Frames 4,5,6,7 : 4000 bytes each
Frames 8,9,10: 2000 bytes each
Frames 11,12 : 400 bytes each

(7 marks)

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