ID Number .....

THE UNIVERSITY OF AUCKLAND

Computer Science 415.314SC

Test 17 September 1998, 7.00 – 8.30pm

- Attempt all questions
- Time allowed $1^1/_2$ hours
- Answer questions in the spaces provided on the question paper
- Approximate calculations only are needed – no calculators allowed
- Parts A and B each carry 50 marks.

A1. You read that "*Ethernet is a very inefficient network because so much data is lost from data collisions*". Criticise and comment on this statement.

[4 marks]

A2. A slotted ring network has a length of 10 km, a data rate of 10 Mbps and 500 repeaters (or stations), each of which contributes a latency of one bit. Assume a cable propagation velocity of 200 m/μs.

(i) What is the total ring latency?

[4 marks]

(ii) Each slot has one source address byte, one destination address byte, two data bytes, and control bits to give a total length of 40 bits. How many slots are on the ring? (*The size of a slot is made slightly larger than usual to ease calculation.*)

[3 marks]

CONTINUED

A3. An IEEE 802.3 packet (including addresses, etc) is seen to start with the following octets.
(*Each octet is labelled below with a sequential number so that you can identify it in your answers.*)

00	00	07	77	B5	49	00	00	B8	1A	14	91	00	40	AA	AA	03	00	00	00	08	00	48	45	4C	4C
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26

(i) Identify the major fields of this record, giving the function of each and identifying fields by their range of octet numbers.

[7 marks]

(ii) How might the start of an IEEE802.5 Token Ring frame (carrying the same information between the same addresses) differ from that shown? (Ignore any "octets" which contain "non-data".)

[2 marks]

(iii) What changes, if any, might be seen if the record was coded for Ethernet rather than 802.3?

[2 marks]

CONTINUED

A4. Briefly describe the operation of <u>one</u> type of spread spectrum communication (include its name in your answer).

[6 marks]

A5. Two stations on a 10BASE5 IEEE802.3 LAN are exchanging messages (requests and responses), with negligible separation between a request and its response and between one response and the next request. There is negligible other traffic. A "request" has 50 information bytes. What sized *data block* should be transferred in the response message to ensure that user information (the data within the response) is transferred as given below (*Assume that an Ethernet or 802.3 message has an overhead of 40 octets in addresses, FCS, preamble, inter-record gap, etc and that there are negligible other delays.*)

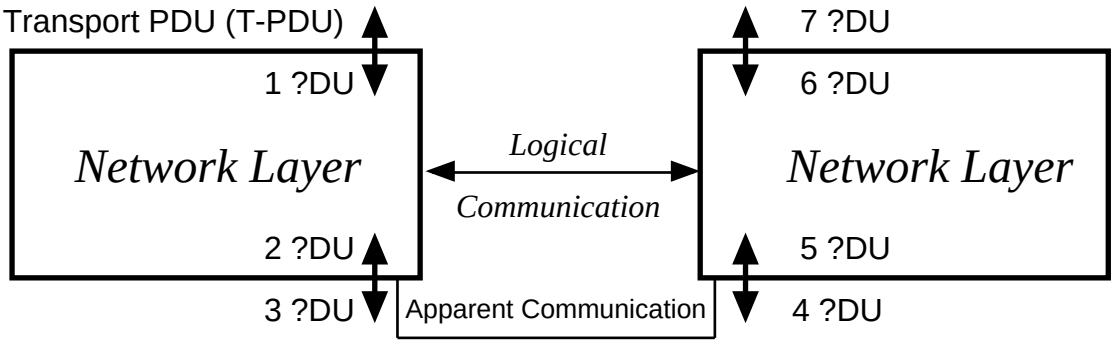
(a) at half the network rate **[4 marks]**

(b) at 90% of the network rate? **[3 marks]**

What are these two transfer rates? **[4 marks]**

CONTINUED

A6. The diagram shows the Network Layers of two communicating stations. The arrows show "Data Units" being exchanged with layers above and below the two network layers.



(i) One of these Data Units is labelled "Transport PDU (T-PDU)". What are the names and abbreviations of the others (1 — 7)?

	Data Unit Name	Abbreviation
1		
2		
3		
4		
5		
6		
7		

[4 marks]

(ii) Explain how the data messages numbered 4, 5, 6 and 7 relate to each other

[3 marks]

CONTINUED

A7. In an actual network, connecting real computers, the observed data transfer rate would be lower than those predicted from Question A5. Suggest reasons for this difference.

[4 marks]

B1. A transmission line may comprise a pair of wires, a wave guide or a light guide.

(i) At approximately what speed does a signal propagate down such a line?

[3 marks]

(ii) List the four kinds of transmission effects a signal will experience over such a medium.

[4 marks]

(iii) If a multimode fibre connects two DTEs separated by 10km, then assuming a 3db/km rate of loss for the fibre, what energy level must be injected into the fibre by the sending DTE if the receiving DTE is to see 5 microwatts of power? (show working).

[3 marks]

CONTINUED

B2. If we have a modulation scheme which utilizes 16 signalling levels and achieves an effective transmission rate of 9600 bits/second, what is the signalling rate in baud.

[3 marks]

B3. Nyquist derived a relationship describing the capacity of a noiseless channel. What was this relationship? Explain all terms in the expression.

[4 marks]

B4. If the channel bandwidth for a transmission system is 3000Hz, and the modulation scheme has 16 signalling levels, what is the capacity of the channel in bits/sec?

[3 marks]

B5. What is the bandwidth efficiency for the channel in Question B4? What are its units?

[3 marks]

B6. What is intersymbol interference? How does this arise?

[3 marks]

B7. A figure of merit for the quality of a transmission channel is the signal-to-noise ratio, which is generally expressed in decibels. Give the expression which is used to convert a signal-to-noise ratio to decibels.

[3 marks]

B8. The Shannon-Hartley law expresses the capacity of a channel in terms of the bandwidth and signal-to-noise ratio. Write down the expression, defining all terms.

[4 marks]

B9. If a channel has a signal-to-noise ratio of 30db, how many signalling levels would a modulation scheme require to achieve the maximum channel capacity?

[3 marks]

B10. Describe the terms “baseband over coax” and “broadband over coax”. Use diagrams to illustrate the differences.

[4 marks]

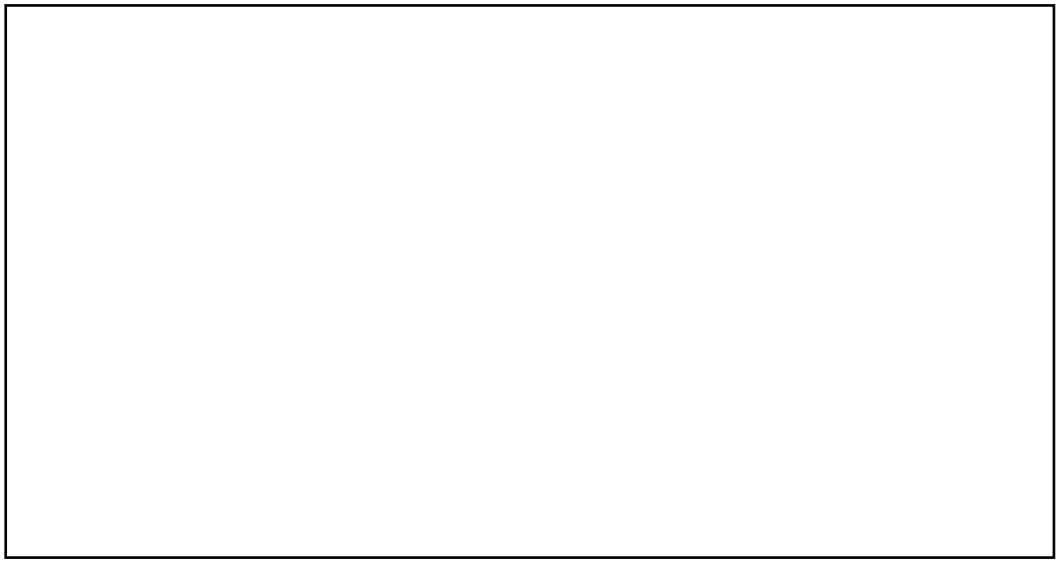
B11. Draw a graph to illustrate the spectral requirements of a system using amplitude shift keying. Label the graph fully.

[3 marks]

B12. Explain the term Pulse Code Modulation (PCM).

[3 marks]

B13. What is the purpose of an Add Drop Mux? Draw a schematic diagram to illustrate how one works.



[4 marks]