ID Number .....

THE UNIVERSITY OF AUCKLAND

Computer Science 415.314FC

Test 16 April 1999, 6.30 – 8.00pm

- 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.
- Queueing formulæ are given later in the question paper.

A1. Briefly describe the *function* of each of the following 802.4 MAC frames, stating when and why it is used. (*Do not discuss the frame format*.)

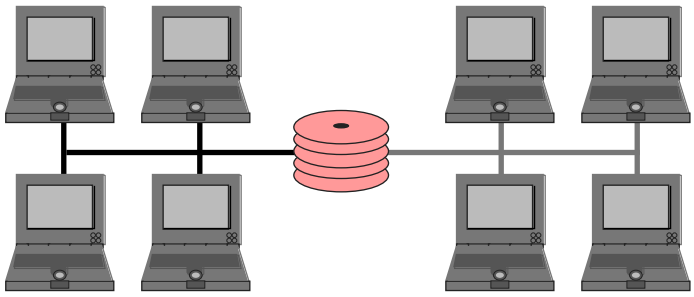
Who_Follows	
Solicit_Successor_2	
Token	

[12 marks]

A2. Show that an Ethernet or IEEE 802.3 frame has an overhead equivalent to *about* 40 octets.

[3 marks]

A3. (i) A disk server has an average access time of 10 ms (0.01s) and is connected to several computers each of which makes one request, on average, each 80 ms (12.5 requests per second). Making the "usual assumptions" of queueing theory, complete the table below, as far as "average time". *Some rows are provided for "working values"*.



Number of computers	→	**4**	**6**	**7**	**8**
arrival rate (per sec)	λ				
service rate (per sec)	μ				
utilisation	ρ				
Avg number in system	*N*				
Avg time in system	*T*				
These rows are available for working if you need them.	$1/(1-\rho)$				

[10 marks]

(ii) What are the "usual assumptions" made in your answers to part (i) above?

[2 marks]

A4. (i) A communications switch has a capacity of 1,000 packets per second. If it is actually working at 250 packets per second, how many buffers are needed to ensure that no more than 1 packet in 1,000,000 is lost from buffer overflow? (Assume 1,000,000 is 2^{20})

[4 marks]

(ii) Repeat the calculation for packet rates of 500/s, 700/s and 835/s.
(Hint: note that $0.7 \approx \sqrt{0.5}$ and $0.835 \approx \sqrt{0.7}$).

Data Rate	Necessary Buffers
500 pkt/s	
700 pkt/s	
835 pkt/s	

[3 marks]

(iii) Approximately how often would packets be lost at each data rate?
(*Give times to within about 5 minutes, or about 10%*.)

Data Rate	Time between lost packets
250 pkt/s	
500 pkt/s	
700 pkt/s	
835 pkt/s	

[4 marks]

A5. An IEEE 802.3 packet is seen to start with the following octets.
(It includes addresses, SNAP header, etc, but *not the preamble and start delimiter*.
Each octet is labelled below with a sequential number so that you can identify it in your answers.)

00	00	66	33	B5	49	00	00	A7	12	36	B7	00	60	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, identifying fields by their range of octet numbers.

[6 marks]

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

[2 marks]

A6. A station may remove itself from a token bus network by just ignoring all messages addressed to it. How then does the ring recover and resume normal operation?

[4 marks]

Queueing formulae

Traffic intensity (or utilisation)	$\rho = \frac{\lambda}{\mu}$
Mean number in system	$N = \frac{\rho}{1-\rho}$
Number waiting in queue	$L_q = \frac{\rho^2}{1-\rho}$
Little's formula	$N = \lambda T$
Average time in system	$T = \frac{1}{\mu(1-\rho)} = \frac{1}{\mu - \lambda}$
Average time in queue	$W_q = \frac{\rho}{1-\rho}\frac{1}{\mu}$
Probability of exactly *n* customers in system	$P_n = (1-\rho)\rho^n$
Probability of over *n* customers in system	$P[N > n] = \rho^{n+1}$

This space available for unmarked working