ID Number .....

THE UNIVERSITY OF AUCKLAND

Computer Science 415.314FC Test

11 April 2000, 7.00 – 8.00 pm

- Attempt all questions
- Time allowed 1 hour : total marks = **50**
- Answer questions in the spaces provided on the question paper
- Approximate calculations only are needed – no calculators allowed
- Two pages for extra answers are at the end of the question/answer paper

1. (a) Explain why parity checks are used in data transmission (why, *not* how) (2 marks)

(b) What is meant by (i) *even parity* and (ii) *odd parity*. (1 mark)

(c) Can a single parity bit detect in a message

- one bit in error (1 mark)
- two bits in error (1 mark)
- more than two bits in error? (1 mark)

(Question = 6 marks)

2. Most communications protocols involve sending a message and waiting for a reply before sending anything more. What features should the protocol include to protect against –

(a) One or more bits being corrupted in a message (1 mark)

(b) Receiving no reply or acknowledgement to a message (1 mark)

(c) The two situations which might result from a lost message, or a lost reply. (2 marks)

(Question = 4 marks)

3. (a) What is flow control, and why is it necessary? (2 marks)

(b) Give three different flow control mechanisms. (3 marks)

(Question = 5 marks)

4 . According to Shannon's result the capacity C of a noisy channel with bandwidth W and signal and noise powers S and N is $C = W \log_2(1+S/N)$.

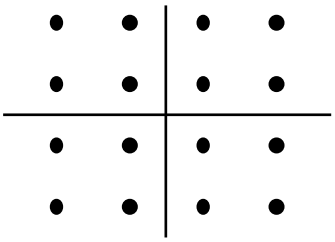
Assuming a channel with a bandwidth of 1 MHz, calculate the channel capacities —

(a) with a signal noise ratio of 0 dB (zero decibels) (3 marks)

(b) with a signal noise ratio of 5 dB (assume $\log_{10}3 \approx 0.5$) (2 marks)

(Question = 5 marks)

5. The diagram shows a signal constellation for a modem or similar communications device.



(a) How many phase shifts are used? (1 mark)

(b) How many amplitudes are used? (1 mark)

(c) What would be the baud rate for 9,600 bit/s? (1 mark)

(d) Why are not all amplitude & phase combinations used? (2 marks)

(Question = 5 marks)

6. A (7, 4) Hamming code uses even parity for each of the checks and has its data bits (D) and parity bits (P) arranged as PPDPDDD. Check the received word 0110101 for errors and correct it if necessary. **(Question = 5 marks)**

7. Briefly explain the functions of the following

(a) The DataLink Layer of the OSI model (2 marks)

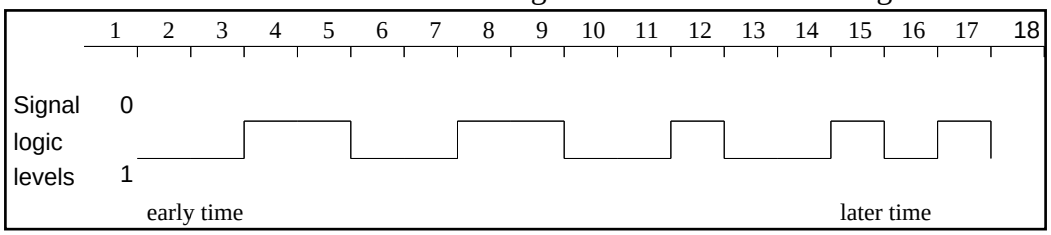
(b) The Network Layer of the OSI model (2 marks)

(c) A “Service Access Point” or “Port” (2 marks)

Explain how information might be transferred between DataLink and Network Layers (in both directions), including the SAPs or Ports. (4 marks)

(Question = 10 marks)

8. This waveform represents an 8-bit character encoded for asynchronous transmission, and includes the start of the next character. Logic "1" is low and "0" is high.



At the top is a scale giving numbers of successive bits.
Use this scale to give the bit numbers of —

(i) the data bits of the first character, (2 marks)

(ii) the stop bit of the first character and (1 mark)

(iii) the start bit of the following character. (1 mark)

(Question = 4 marks)

9. Four stations are waiting to transmit with a *p*-persistent protocol ($p = 0.2$).
Show that the probabilities of no station attempting to transmit and of a successful transmission are both about 40%.

(a) The probability of no station attempting to transmit (2 marks)

(b) The probability of a successful transmission. (2 marks)

(Question = 4 marks)