COMPSCI 314 S1 C Assignment 1

Department of Computer Science

The University of Auckland

Due Wednesday 15 March 06, 11:59 pm

This assignment will contribute 30/300 = 10% to your coursework mark, and 3% to your overall course mark.

Submit your assignment via the DropBox, either in PDF (preferred), or in MS Word format.

These are all short-answer *questions, one or two sentences (or a short calculation with some comments) are all that is needed to answer them. Read each question carefully right through* before *you begin to answer it!*

1. **Packet Switching** [10 marks]

   Consider a *connectionless packet switching network*, like the one illustrated in figure 1.6(b) in the textbook (slide 12 of the lecture notes).

   (a) What is meant by the term 'packet?' [2 marks]

   > A 'packet' is a sequence of bytes, a subset of the bytes a user wants to transmit across a network. *Each packet is sent separately, rather than sending all the data in a continuous flow.*

   (b) How do network nodes determine where to send an incoming packet? [2 marks]

   > Each packet begins with the destination node's network address. *Each node maintains tables ('forwarding' tables) telling it which interface to send on to reach any particular destination network.*

   (c) How does a receiving host such as B discover which host it should send a reply to? [2 marks]

   > Each packet has the sender's address in its header. *in the textbook diagram the header has destination address, then source address.*

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(d) What delays will a packet encounter as it passes through the network? [2 marks]

> Packets will be delayed by the time it takes for them to propagate along each link (speed of light). Also, the switch nodes may need to hold packets in a queue. *If that happens a lot, we say the network is* congested.

(e) Would you expect the total delay for packets between hosts A and B to be constant? Explain your answer. [2 marks]

> No. It would only be constant if there were never any queueing delays. *In practice we can't predict peaks in traffic along paths, so we always see some variation in packet delays.*

2. **Signal Propagation** [10 marks]

The Southern Cross Cable provides a fibre link from Auckland to Los Angeles, a distance of about $10,000km$. The velocity of light in the fibre is about $2 \times 10^8 m/s$. Assume that we can send data at a rate of $50Mb/s$ ..

(a) How long does it take for one bit to propagate (travel) from Auckland to Los Angeles? [3 marks]

> $time = distance/speed = \frac{10^7}{2\times10^8} = 50ms$

(b) How long will it take for us to transmit a packet of 1500 (8-bit) bytes? [3 marks]

> 1500 B take $\frac{1500\times8}{5\times10^7} = 240\mu s$ to send.

(c) If we were to send bytes continuously, what is the maximum number of *bytes* 'in flight' on the link at any time? [4 marks]

> Bytes sent in $50ms$ = $5 \times 10^{-2} \times \frac{5\times10^7}{8} = 312.5kB$

3. **Transmission Schemes** [10 marks]

(a) In a link using *asynchronous character* transmission, How are incoming characters recognised? [2 marks]

> The line is held high to indicate that it is connected and idle. When a character is to be sent, the line is pulled down and held there for one bit cell time; that is the 'start' bit, indicating that a new character is about to be sent.

(b) How are characters arranged into frames, so that the start and end of a frame can be determined? [2 marks]

> Using two special 'control' characters, STX (start of transmission) and ETX (end of transmission). Characters between STX and ETX are the body (i.e. contents) of the message.

(c) In a link using *synchronous* transmission, how is the receive clock synchronised with the transmit clock? [2 marks]

> Clock information is sent along with the data signal; the receiver recognises the incoming clock information and uses it to synchronise its own clock. *Manchester or Differential encoding ensure that there's at least one signal transition within each bit cell; that's enough for the receiver to synchronise with.*

(d) How is the start of a frame recognised on a synchronous link? [2 marks]

> The receiver watches the incoming bit stream, looking for a SYN (character framing) or FLAG (bit framing) character. *A frame starts when we see two SYNs /FLAGs followed by either STX or DLE STX.*

(e) What advantage is gained by using synchronous (rather than asynchronous) transmission? [2 marks]

> We don't have to send start and stop bits, i.e. it takes 8 bits to send a byte rather than 10 or 11.