1. Explain how a ***reliable connection-oriented*** end to end service can be supported by an underlying ***un-reliable connectionless*** network (similar to IP)

A reliable service is typically implemented by having the receiver confirm to the sender that it correctly received each message (which introduces extra overhead and delays) and can be done with an un-reliable underlying network. A connection can be established end-to-end though a connectionless network by the virtual set-up and re-ordering of the data at the ends.

2. Give an example of a ***wireless*** but ***non-mobile*** network application, and also a ***mobile*** but ***non-wireless*** application.

Wireless	Mobile	Example Application
yes	no	wireless LAN in unwired office
no	yes	using a (non-wireless) laptop PC

3. Briefly explain why the ***Go-Back-N ARQ*** is often implemented as a Go-Back-7 scheme and how might this be extended.

N(S), N(R) 3 bits long, window size = 7;

in "extended mode", N(S), N(R) 7 bits long, window size = 127

4. Explain why ***TCP*** has to worry about data arriving out of sequence, as datagram fragmentation and reassembly are handled by ***IP*** and are invisible to ***TCP***.

Although each IP datagram arrives intact, the datagrams themselves may be out-of-order, requiring TCP to reassemble the transmitted message.

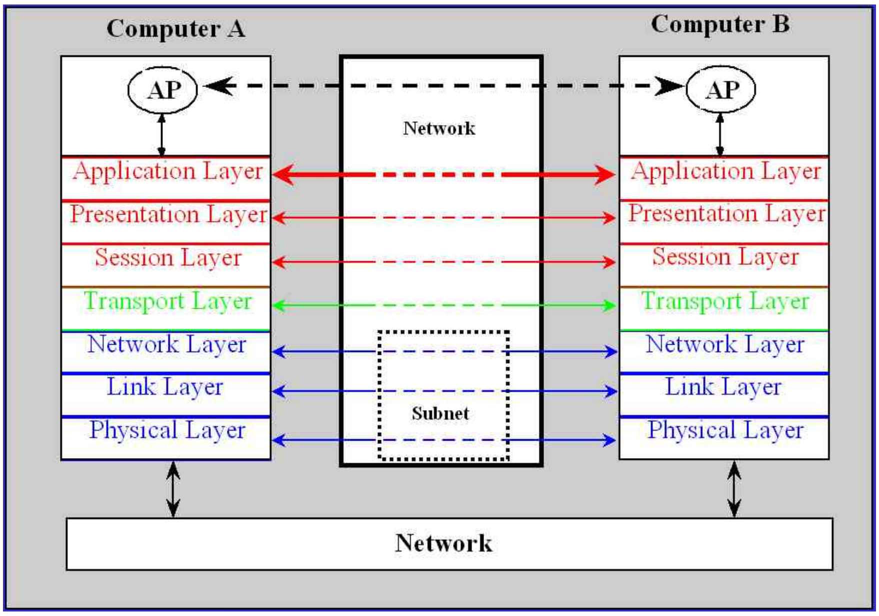
6. Briefly explain the differences between ***IEEE 802.11a and 802.11.g*** and how a user might be affected by the different implementations.

Standard	**Data rate**	**Throughput**	**Band**	**Range - Indoor**
802.11g	54Mbps	29Mbps	2.4Ghz	40m
802.11a	54Mbps	29Mbps	5Ghz	15m

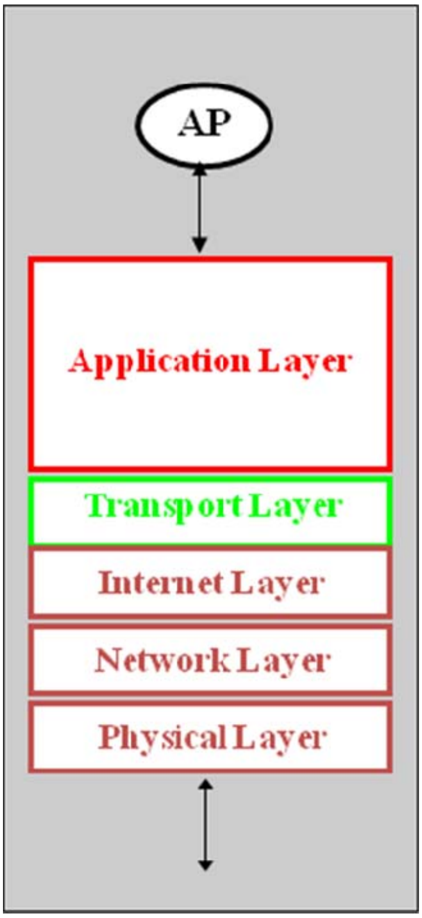
5. Explain what a mask of **255.255.128.0** means in the ***IPv4*** addressing scheme and show how this might be used both within an autonomous network and also outside one.

- 11111111.11111111.10000000.00000000
- ***masking*** of IP addresses during the packet-forwarding process
- masking is done whether or not subnetting is being used
- masking means taking ***bit-by-bit AND*** of IP address and mask (255 ≡ all 1's, 0 ≡ all 0's)
- within a network only look at what is the local part, outside only look at the network ID part.

Problem set 2 solutions in question 5 "TCP/IP model only provides a connectionless **network** layer service" and in question 6 "For example, TCP and IP combine to support a connection-oriented communication service".


Computer A
Computer B
AP
AP
Network
Application Layer
Presentation Layer
Session Layer
Transport Layer
Network Layer
Link Layer
Physical Layer
Application Layer
Presentation Layer
Session Layer
Transport Layer
Network Layer
Link Layer
Physical Layer
Subnet
Network

TCP/IP Model


AP
Application Layer
Transport Layer
Internet Layer
Network Layer
Physical Layer

Resit paper 2010-2011

Q1

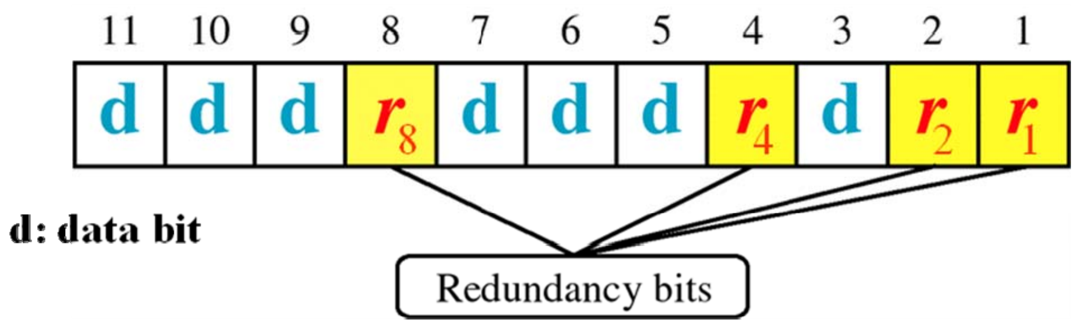
(e) 250 nodes are connected to a 5000 metre length of coaxial cable. Using some (unspecified) protocol, each node can transmit 70 frames/second, where each frame is 100 bytes long. The transmission rate at each node is 100 Mbps. What is the efficiency of this protocol (numerically)? **[8 marks]**

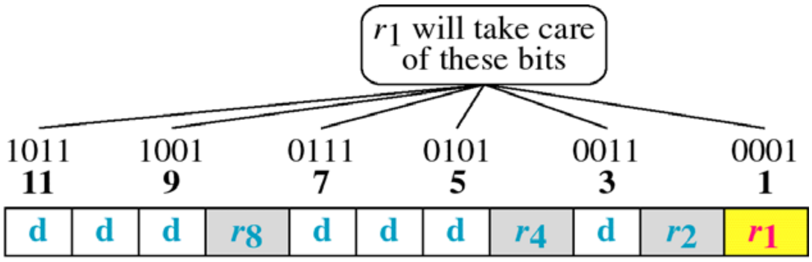
250 nodes * 70 frames/second * 100 bytes = 14,000,000 bits/sec

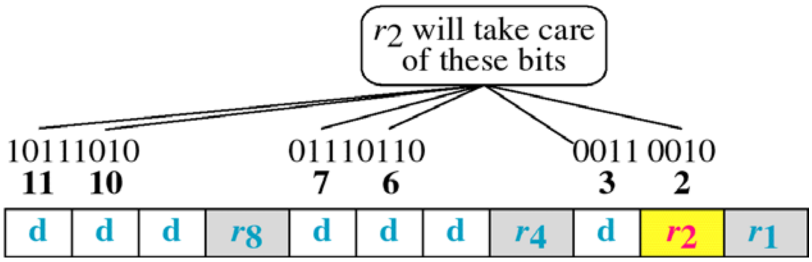
14 Mbps on 100 Mbps = 14% efficiency

Q2 (e), Hamming code

The following data is received from a channel using the ***Hamming Code*** “**11010011001**” Decode this correctly to find the transmitted bit sequence. **[5 marks]**



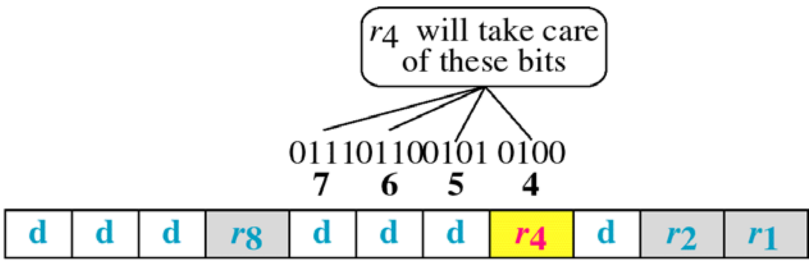


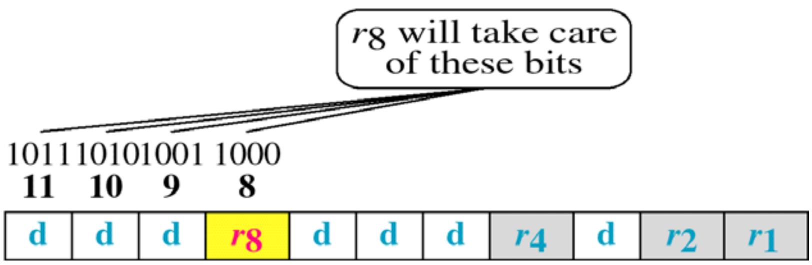


11 10 9 8 7 6 5 4 3 2 1

1 1 **0** 1 **0** 0 **1** 1 **0** 0 **1**

means r1 = 1, r2 = 0,





11 10 9 8 7 6 5 4 3 2 1

1 1 0 1 **0 0 1 1** 0 0 1

r4 = 0, r8 = 1, so 1001 = 9th in error

This is the correct one therefore **11110011001**

Q3 (a)

Show how you would transmit this data "**001111101000**" by both adding the HDLC start and end of frame, as well as ensuring that the Flags were understood at the receiver. **[5 marks]**

01111110 **0011111001000** 01111110

(b)

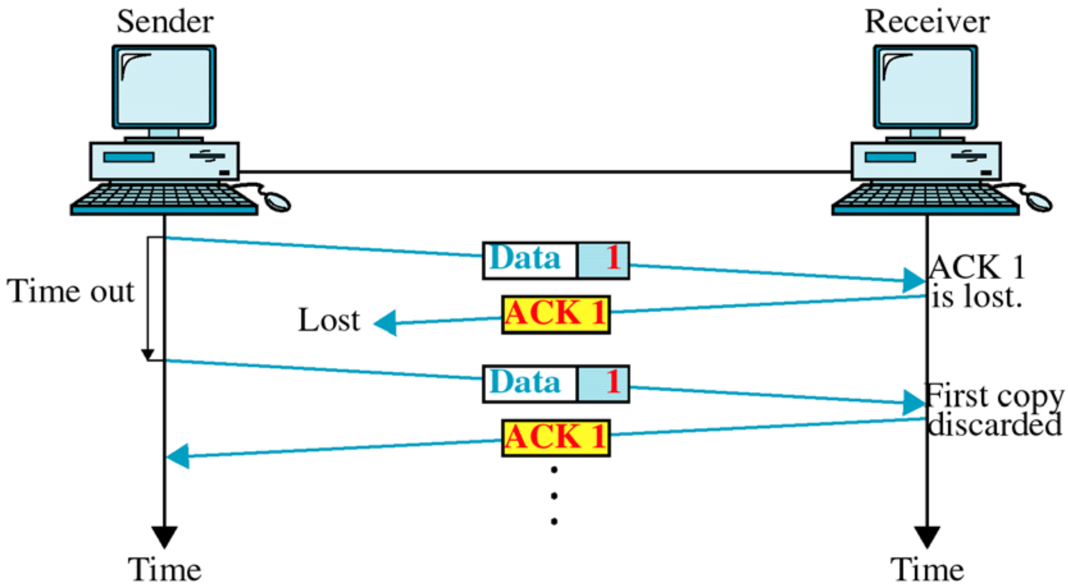
What is the probability, in percent, of an ***Ethernet*** (1500 Byte) frame being in error, given that 1 bit in a million is in error on average. **[5 marks]**

1500 Bytes * 8 Bits = 12,000 bits * 0.000001 = 0.012 = 1.2%

(e)
Explain why ***TCP*** has to worry about data arriving out of sequence, as datagram fragmentation and reassembly are handled by ***IP*** and are invisible to ***TCP***. **[5 marks]**

Although each IP datagram arrives intact, the datagrams themselves may be out-of-order, requiring TCP to reassemble the transmitted message.

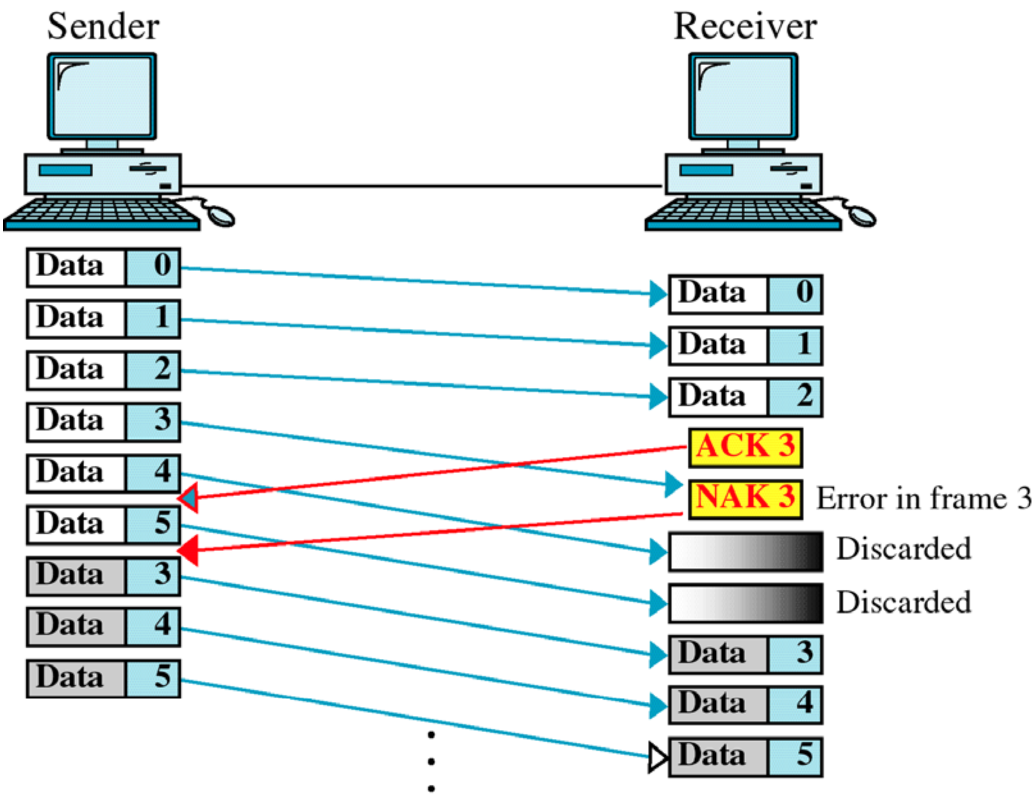
(b)
Draw an example of the ***Stop-and-Wait ARQ*** showing that the use of sequence numbers is required in both the I-Frame and the S-Frame. **[5 marks]**



If the ack1 was just delayed another bit, then it would arrive just after the resent frame and so would think this is an ack, and then the next ack1 would be used for the next frame.

(c)

Give an example of a ***Go-Back-N ARQ*** showing what happens when the CRC does not match the data field, and how the system might recover. You should indicate the sequence numbers on all the frames. **[5 marks]**



- Simplex & Half Duplex - examples of use

Printer, screens, mouse, keyboard, DSL connections

- Significance of GoBack7 in GoBackN

Three bits allocated, hence 8 number (0,1,2,3,4,5,6,7) and so the maximum is the go-back-7

- Token Bus: "different physical layer to Ethernet (allows symbols other than 0 or 1)"??

Ethernet has typically only the capability for sending a 0 and a 1, whereas it is possible to have many more different types of symbols.

- Virtual Circuit: "Need capability to route isolated packets from an arbitrary source to an arbitrary destination" (ProblemSet4 Q2)

Just because you have a connection, you still might only have a single packet (frame) to send on it. Not efficient but could be the case.