Please answer any THREE Questions from the FOUR questions provided

For full marks your answers should be concise as well as accurate. Marks will be awarded for reasoning and method as well as being correct

This paper will be taken on-line and this is the paper format which will be available as a back-up

The use of electronic calculators is permitted provided they are not programmable and do not store text.
1. Compare and contrast the capability of the three protocols below to support reliable real-time multi-media data exchange.

a) TCP, (8 marks)

b) UDP with RTP + RTCP and (6 marks)

c) Second Life’s protocol hierarchy built on top of UDP including Message, Accounting, and Transfer Manager (6 marks)

Identify up to three of the most significant advantages and disadvantages associated with using each of the above approaches to transfer multi-media data. Briefly justify your choices.

2. a) Using diagrams, briefly explain the difference between QPSK and 16-QAM. (8 marks)

b) Explain how the bit sequence 0111 1110 0111 111 would be sent as a packet using HDLC. (5 marks)

c) How and why do wireless networks:

i) Adapt their packet headers to allow for the difference between wired and wireless physical media? (4 marks)

ii) Adapt their data rate whilst still ensuring that most connected wireless devices can work out who the transmission is for (i.e. destination) and when the transmission will finish? (3 marks)
3. a) With the aid of examples, explain the difference between implicit and explicit typing of application data.

b) Explain why typing of application data can be a significant issue for network applications. (2 marks)

c) A network application is to be written that must run on a variety of different types of computer hardware and operating systems. The distributed parts of this application exchange one type of message that contains a fixed sized string and a variable sized array of integers. Describe a strategy for sending data that will allow all parts of this distributed application to correctly receive messages sent from any other instance of the application. Illustrate your answer with a diagram that indicates where any conversions needed are performed. (5 marks)

d) If all instances of the application described in part c) happen to run on the same computer hardware and operating systems, in terms of the use of networking resources (bandwidth and CPU cycles), discuss the pros and cons of the conversion strategy that you described in part c). (4 marks)

e) In the context of distributed network applications, give a definition for extensibility. Describe an example of the use of extensibility in applications; include an explanation of how the extensibility that you describe works. (4 marks)

4. a) Describe, in terms of transport level protocol operations, the process via which a client connects to a server. You should illustrate your answer with a diagram. (4 marks)

b) For a communication where host A sends host B five bytes of data every four seconds and the propagation delay between host A and host B is one second (ignore any transmission delays), show how TCP uses acknowledgements, timeouts (six seconds) and sequence numbers (initial value one) to make the transmission of data between the two hosts appear reliable when the second transfer is lost (bytes 6-10). You should assume that the first transfer occurs at time zero and that the TCP window size is sufficiently large to allow all bytes to be sent. (5 marks)

(Question 4 continues on the following page)
c) Explain, in TCP terms, what a transmission window is and why they are used. Show how TCP uses windows to allow a receiving host to control the data sent from a sending host including stopping all transmissions. Explain why not returning acknowledgements to the sending host is not an efficient way to achieve the same effect. (6 marks)

d) The following picture shows the structure of the network being used by an organisation. The Internet authorities have allocated this organisation the block of network addresses 194.213.0.0-194.213.64.0. By using the Classless Inter-Domain Routing (CIDR), decide how these addresses should be allocated within the organisation, and what netmasks should be used, to allow all of the organisation’s hosts to be fully connected to the Internet. (5 marks)