1. Communication is a process whereby information is enclosed in a package and is channelled and imparted by a sender to a receiver via some medium. The receiver then decodes the message and gives the sender a feedback. All forms of communication require a sender, a message, a recipient, a code and a channel. In addition, a channel might present noise. Outline these 6 different elements in each one of these different examples of communication [2 marks each]:
   - a teacher talking to pupils;
   - a message found in bottle;
   - a computer downloading a software update;
   - a song being listened to.

2. What is a protocol? Describe two reasons why protocols should be layered in a protocol stack. [8 marks]

3. What do we mean by layer violation? Discuss some of the reasons that might lead a pragmatic protocol implementer to engage in layer violation and illustrate with an example. [10 marks]

4. What is the difference between a connectionless and connection-oriented communication? Give two practical examples. [6 marks]

5. Where would each of the following fit into the OSI model? [3 marks each]
   - a HTTP/HTTPS proxy server;
   - a VPN (i.e. tunnelling IP packets over an encrypted channel based on UDP or similar)
   - RFC 1149: A Standard for the Transmission of IP Datagrams on Avian Carriers

6. A person enters a status update into the Twitter website and clicks the submit button. Describe how the data in this message traverses the various layers of the network stack between the PC and the server. Identify the protocols involved, the systems that operate on these protocols, and the corresponding layers in the OSI model represented by those protocols. [8 marks]
   How would this traversal differ if the user had updated their status via text message? What part(s) of the traversal would remain the same? [2 marks]

7. Define a simple communication protocol over Facebook chat that would allow you to organise a meeting with your friends. Define the general assumptions of the protocol as well as a set of PDU’s and their semantics. After a successful protocol interaction the 2 people should be able to agree on the time and place of the meeting. [8 marks]
   In which layer of OSI would you place this protocol? [1 mark]