6. (a) (i) Explain the term *protocol*, and describe the purpose and operation of a 'layered protocol' structure. [4]

(ii) A system has an *n*-layer protocol hierarchy. Applications generate messages of length *M* bytes. At each of the layers, an *h*-byte header is added. What fraction of the network bandwidth is filled with headers? [2]

(b) (i) Describe the TCP/IP Reference Model and briefly mention the purpose of each layer. [5]

(ii) Explain the term *jitter*, and state one application for which it is important to minimise jitter. [3]

(iii) Describe how TCP segment flow is controlled using a sliding window. [4]

(iv) In TCP, why is efficiency reduced if an application is producing too little data at a time for TCP transmission, or an application is consuming too little of the data received. Suggest solutions that can be employed to reduce these inefficiencies. [4]

(v) The round-trip time between two hosts has been found to be 64ms. If the bit rate of the link between the hosts is 480 kbps, what minimum TCP window size (in bytes) is required such that, when data is continually being sent, the buffers will not overflow? [3]