**5   Computer Networking (awm22)**

(*a*)  You need to urgently deliver 500 TByte of data from Zurich to London.

(*i*)   NoWayNet is offering a 10 Gbit/s reliable delivery service between Zurich and London (about 776km).  Should you use either NoWayNet, or an overnight package delivery? Why?                                    [2 marks]

(*ii*)  A new company, UnlikelyComms, is offering a 400 Gbit/s reliable delivery service between Zurich and London, but it takes a very indirect 2600 km path. Should you use UnlikelyComms?                    [2 marks]

(*iii*) Following your successful urgent delivery of 500 TBytes of data, this has become an hourly task. Alongside the need to regularly deliver 500 TByte data between Zurich and London, you have an interactive virtual reality system; it requires six displays each needing 50 Gbit/s and an end-to-end latency of less than 5ms.

Fortunately, a startup, FlyByNight, boasts an offering with an effective bandwidth of over 16 Tbit/s, using a *special* transport with no end-to-end latency at all. The downside is it can only transfer data in 500 TByte units, once every 4 minutes. Explain whether FlyByNight is, or is not, suited to your two workloads.                                    [4 marks]

(*b*)  Ethernet standards enable 1Gbit/s over 4 pairs of twisted cabling, yet the physical media has a bandwidth much less than 1GHz, e.g., 250MHz is common.

(*i*)   Explain how such high data rates are achieved, and           [4 marks]

(*ii*)  explain how physical media errors are reduced or eliminated.     [2 marks]

(*c*)  Explain, with the aid of diagrams, how Code-Division Multiple Access permits two or more pairs of nodes to communicate over a common medium (e.g., wireless) simultaneously.                                    [6 marks]