COMPUTER SCIENCE TRIPOS Part II – 2022 – Paper 8

10   Principles of Communications (jac22)

(a) Imagine you are set the task to optimise road traffic, so that journey times are
minimised for a given set of vehicles moving between a known set of sources and
destinations. You have the freedom to fix routes and to control speed limits on
routes. How can you tackle this problem?   [5 marks]

(b) Now imagine we have roads with electronic signage that allows us to declare
variable speed limits. What approach could you take to setting the speeds to
minimise congestion?   [5 marks]

(c) In an effort to reduce traffic congestion, the government decides to introduce a
charge for using the roads during the busiest times of day. Explain how this may
lead to an increase in the overall welfare of all drivers. Answers should include
discussion of concepts such as willingness to pay, and peak rate charging.
                                                                              [5 marks]

(d) Without imposing strict routes, each car driver chooses a path independently,
but what about a delivery fleet of vans/trucks? Perhaps parts of the road
network are set aside for a known set of flows of haulage vehicles. How could
this differentiation between individual and groups of vehicles be deployed?
                                                                              [5 marks]