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Fantasia is an island nation with a population of 250,000.

The country has several large towns joined by a network of dual carriageway roads. These are known as class one roads. Smaller towns and villages are joined to the class one roads by single carriageway roads. These are known as class two roads. All other rural roads are called class three. Urban roads are classified as class four.

Class 1	Dual carriageways	Join large towns
Class 2	Single carriageways	Join small towns and villages
Class 3	Single carriageways	Other rural roads
Class 4	Various	Urban roads

The Fantasians pay an annual vehicle tax to maintain the roads. There are five groups of vehicles. Each group is taxed at a different rate.

Group A	Motorcycles	Two wheeled, motor driven vehicles
Group B	Cars	Private passenger vehicles
Group C	Buses and taxis	Passenger vehicles that take paying passengers
Group D	Lorries	Freight carrying vehicles
Group E	Agricultural	Agricultural vehicles such as tractors

The Transport Ministry keeps the tax records in a database. Some of the tables in the database are OWNER, VEHICLE, and LINK

- OWNER (ID number, family name, first name, address line 1, address line 2, district, address code, date of birth, licence)
 - *ID number*. All Fantasians have a seven-digit ID number allocated to them.
 - *district*. Each town in Fantasia has a district surrounding it, e.g. the district of Fant covers the town of Fant and an area of surrounding countryside.
 - *address code*. Each district is divided into smaller areas, each with an address code, e.g. the address code of the area containing the Transport Ministry is Fant2332.
 - *licence*. This shows which vehicles the person is allowed to drive. The vehicle groups are the same as the tax groups and a person may be licensed for more than one group.

- VEHICLE (vehicle number, group, make, model, tax date, first registered)
 - *vehicle number*. All vehicles must display an eight-digit vehicle number. The first four digits are the year the vehicle was first registered.
 - *tax date*. This is the month when the tax is due to be paid.
 - *first registered*. This is the date when the vehicle was imported into Fantasia.

- LINK (vehicle number, ID number)

All vehicle owners are required to pay the tax annually at a tax office in Fant. There are only a small number of officials to check that vehicles have been taxed. This has led to widespread evasion of payment. The Transport Minister has therefore decided to implement a new road charging system to replace the vehicle tax.

The system is to be based on the number of kilometres (km) driven on each class of road, and on the vehicle group.

Two methods were suggested for measuring the distance driven by each vehicle.

Camera measurement

This involves having cameras at frequent intervals along the island's road system to read the eight-digit vehicle numbers. The cameras would be connected to a central computer. Character recognition software would then be used to determine which vehicle had been photographed. The road charge would be calculated according to which cameras had seen a vehicle.

GPS measurement

This involves each vehicle being fitted with a 'black box'. The box would contain a Global Positioning System (GPS) receiver. The black box would log the position of the vehicle at regular intervals and calculate the distance travelled. The black box would contain digital maps of the island's road system and would know which class of road the vehicle was using. The black box would send a report back to a central computer by radio, at set times.

The Transport Minister decided to test both methods in an area around Fant.

To test camera measurement, ten cameras were set up on roads between Fant and a nearby town. The cameras were mounted on street lights so that they could be powered from their electricity supply. Information from the cameras was sent to the Transport Ministry for analysis.

To test GPS measurement, ten government vehicles in Fant were fitted with a 'black box'. Each black box was linked to a laptop once a day so that the stored information could be taken to the Transport Ministry for analysis.

To help to calculate the road charges, two new tables CHARGE and TAX RATE were added to the database.

- CHARGE (vehicle number, class 1 km, class 2 km, class 3 km, class 4 km, cost)
 - *class 1 km* is the number of kilometres travelled on class 1 roads.
 - *cost* is the amount payable by the vehicle owner.

- TAX RATE (class 1, class 2, class 3, class 4, group A, group B, group C, group D, group E)
 - *class 1* is the charge per kilometre for class 1 roads.
 - *group A* is a multiplier for group A vehicles.
The cost for travelling 1 km on a *class 1* road for a *group A* vehicle is $class\ 1 \times group\ A$

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