COMPUTER SCIENCE TRIPOS Part IA − 2023 − Paper 3

1 Databases (djg11)

(*a*) A manufacturer makes three models of vehicle that vary in their engine type and number of seats. One model is available in two paint colours. Engines are either petrol or electric. Engines come from different suppliers, dependent on their fuel and horsepower.

  (*i*)   Draw a suitable E/R diagram.   [4 marks]

  (*ii*) By writing out a suitable number of short tables, give a small relational database example holding vehicles and engines. Make sure every field has a name. Underline table keys.   [3 marks]

  (*iii*) Which fields in your example are foreign keys? Explain whether your example satisfies referential integrity.   [2 marks]

(*b*) The SQL language contains a `GROUP BY` construct.

  (*i*)   Explain why the data returned by `GROUP BY` has to be passed through a reduction operator before it can be returned in a table?   [2 marks]

  (*ii*) What mathematical properties should such a reduction operator have? Explain why.   [2 marks]

(*c*) A distributed database may use *eventual consistency*. Explain what this is. Give two advantages.   [3 marks]

(*d*) State the principle disadvantage of *eventual consistency*? Provide a simple example.   [2 marks]

(*e*) Explain why a graph database typically holds just one graph?   [2 marks]