

1.3 EXCHANGING DATA · 1.3.2

Normalisation to 3NF & referential integrity — Mark scheme

33 marks · spec 1.3.2(c)(e)

AO key: AO1 = knowledge & understanding · AO2 = application · AO3 = reasoned judgements. Accept any valid alternative; do not award the same point twice.

Q	ANSWER	AO	MARKS
1(a)	Organising data into tables to remove redundancy / avoid anomalies. (1)	AO1	1
1(b)	1 mark per point, max 3: <ul style="list-style-type: none"> • less data redundancy / smaller database (1) • avoids inconsistency / update anomalies (1) • easier and safer to update / maintain (1) 	AO1	3

Q	ANSWER	AO	MARKS
2(a)	No repeating groups (1); every field holds a single/atomic value (with a primary key) (1). (2)	AO1	2
2(b)	One field lists several passengers (a repeating group / non-atomic value) (1), so a record is not a single set of atomic values (1). (2)	AO2	2
2(c)	Put each passenger on its own row / in a separate Passenger table (1) linked by a key, so each field holds one atomic value (1). (2)	AO2	2

Q	ANSWER	AO	MARKS
3(a)	ProductName depends on only part of the composite key (ProductID), not the whole key (1); this is a partial dependency, which 2NF does not allow (1). (2)	AO2	2
3(b)	1 mark per point, max 3: <ul style="list-style-type: none"> • a transitive dependency is where a non-key field depends on another non-key field (1) • e.g. CustomerName depends on CustomerID, not the primary key (1) • 3NF requires non-key fields to depend only on the key, so this prevents 3NF (1) 	AO1	3
3(c)	With a single-field key, no field can depend on only part of the key, so no partial dependency can exist. (1)	AO2	1

Q	ANSWER	AO	MARKS
4(a)	A foreign key value must match an existing primary key in the related table (1); so no orphaned records (1); valid example, e.g. an Order's CustomerID must exist in Customer (1). (3)	AO1	3
4(b)	Deleting a primary-key record that is still referenced (1) (or inserting a foreign key with no matching primary key) leaves an orphaned record (1). (2)	AO2	2

Q	LEVELS-OF-RESPONSE MARK SCHEME	AO	MARKS										
5	<p>Mark using the levels descriptors below. AO1 (knowledge of the normal forms), AO2 (applying them to the given table).</p> <table border="1"> <thead> <tr> <th>LEVEL</th> <th>DESCRIPTOR</th> </tr> </thead> <tbody> <tr> <td>Level 3 (9–12)</td> <td>Works correctly through 1NF, 2NF and 3NF, explaining the change at each stage and giving the correct final tables and keys. Accurate and well structured.</td> </tr> <tr> <td>Level 2 (5–8)</td> <td>Reaches at least 2NF correctly with some explanation of the changes; final tables mostly correct.</td> </tr> <tr> <td>Level 1 (1–4)</td> <td>Basic attempt at normalisation with limited explanation or errors in the tables/keys.</td> </tr> <tr> <td>0</td> <td>Nothing creditworthy.</td> </tr> </tbody> </table> <p>Indicative content (credit any valid working):</p> <ul style="list-style-type: none"> • 1NF: remove the repeating group so each row is one product; composite key (OrderID, ProductID). • 2NF: ProductName depends only on ProductID → Product(ProductID, ProductName); the order/customer fields depend on OrderID. • 3NF: CustomerName depends on CustomerID (non-key) → Customer(CustomerID, CustomerName). • Final tables: Customer(<u>CustomerID</u>, CustomerName); Order(<u>OrderID</u>, CustomerID*); OrderLine(<u>OrderID*</u>, <u>ProductID*</u>, Quantity); Product(<u>ProductID</u>, ProductName). (* = foreign key) 	LEVEL	DESCRIPTOR	Level 3 (9–12)	Works correctly through 1NF, 2NF and 3NF, explaining the change at each stage and giving the correct final tables and keys. Accurate and well structured.	Level 2 (5–8)	Reaches at least 2NF correctly with some explanation of the changes; final tables mostly correct.	Level 1 (1–4)	Basic attempt at normalisation with limited explanation or errors in the tables/keys.	0	Nothing creditworthy.	<p>AO1 ×5 AO2 ×7</p>	12
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Total for paper: 33 marks