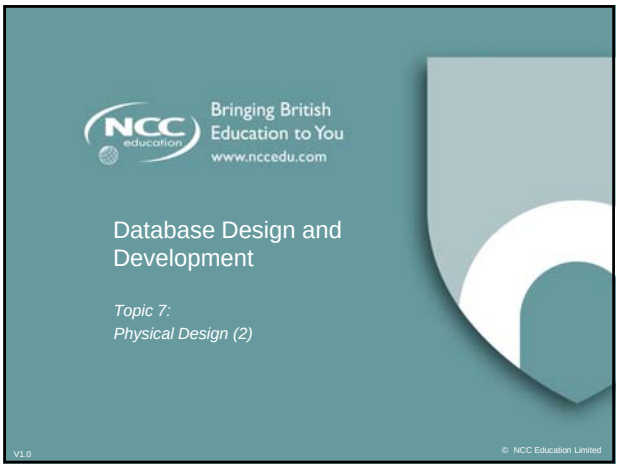
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Database Design and Development
Topic 7:
Physical Design (2)
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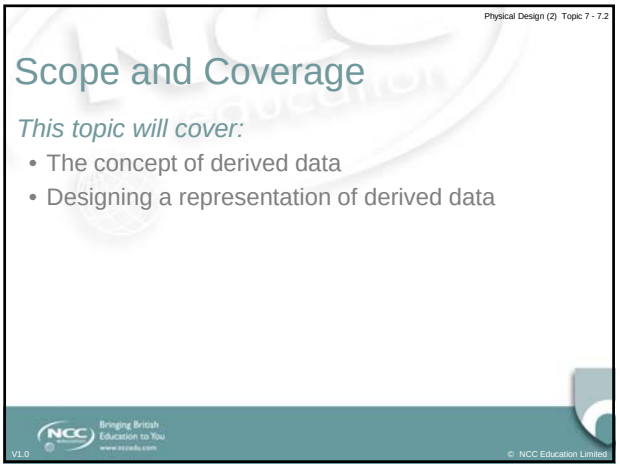
Physical Design (2) Topic 7 - 7.2
Scope and Coverage
This topic will cover:
• The concept of derived data
• Designing a representation of derived data
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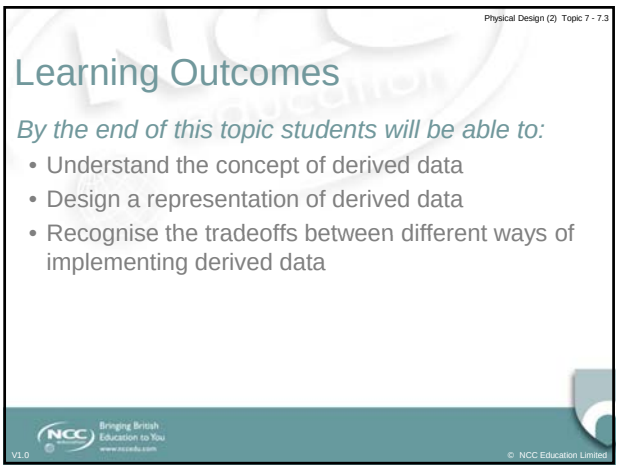
Physical Design (2) Topic 7 - 7.3
Learning Outcomes
By the end of this topic students will be able to:
• Understand the concept of derived data
• Design a representation of derived data
• Recognise the tradeoffs between different ways of implementing derived data
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What is Derived Data?

- A column whose value can be found be examining the values of other columns

Table: AcademicClasses

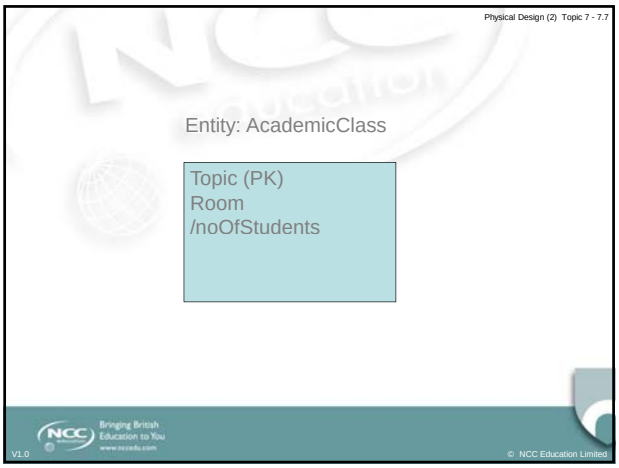
Topic	Room	NoOfStudents
Chemistry	87	30
Mathematics	99	12
English	32	23
Computing	55	30

What is a derived column here?

Where might it be derived from?

Representation of Derived Data

- Not always represented in the data model
- Represented when there is a danger of losing the information
- Derived attributes shown with a '/' in front


Physical Design (2) Topic 7 - 7.7
Entity: AcademicClass
Topic (PK)
Room
/noOfStudents
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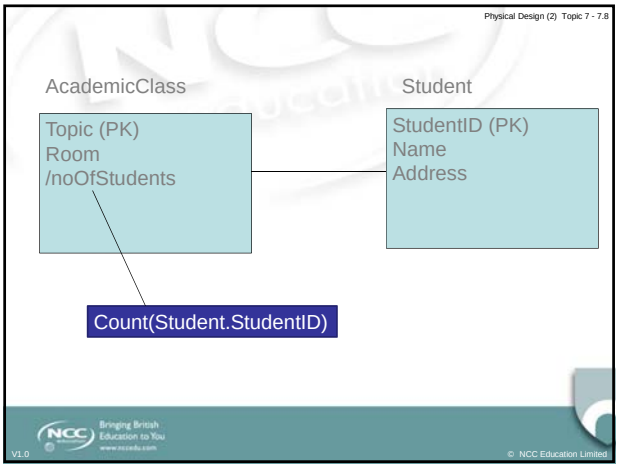
Physical Design (2) Topic 7 - 7.8
AcademicClass
Topic (PK)
Room
/noOfStudents
Student
StudentID (PK)
Name
Address
Count(Student.StudentID)
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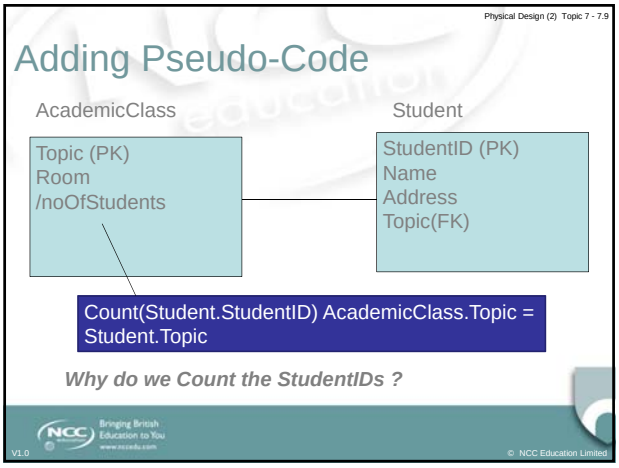
Physical Design (2) Topic 7 - 7.9
Adding Pseudo-Code
AcademicClass
Topic (PK)
Room
/noOfStudents
Student
StudentID (PK)
Name
Address
Topic(FK)
Count(Student.StudentID) AcademicClass.Topic = Student.Topic
Why do we Count the StudentIDs ?
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What Sort of Documents/ Applications will use Derived Fields? - 1

- ***Activity:*** Brainstorm – write down as many documents or applications that might use derived fields in a business.

What Sort of Documents/ Applications will use Derived Fields? - 2

- ***Activity:*** Brainstorm – write down as many documents or applications that might use derived fields in a business.

Receipts

Invoices

Order Forms

Using Derived Data to think about a Data Model

- Remember data modelling is about semantics, the meaning of the data.

Original Customer Order Sheet for Art Supply Shop

Customer Order Sheet for an Art Supplier

Customer Number: 37
Customer Name: Jagpal Singh
Customer Type Code: RC
Customer Type Description: Retail Customer

Item Number	Item Name	Supplier ID	Price	Supplier Name	Quantity
099	Basic Paint Set	S1	£3	Smith and Co	1
0100	Sable Brush Set	S2	£3.50	Acro	1
0101	Extended Colour Set	S1	£3.75	Smith and Co	3
098	Metallic Paint Set	S1	£3.99	Smith and Co	1
078	Mixed Brush Set	S2	£3.99	Acro	2

Adding a Total for Each Item and the Order Itself

Order ID: 4343

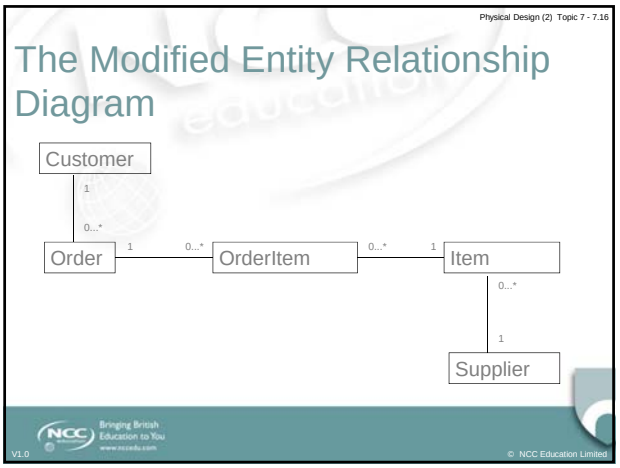
Customer Order Sheet for an Art Supplier

Customer Number: 37
Customer Name: Jagpal Singh
Customer Type Code: RC
Customer Type Description: Retail Customer

Item Number	Item Name	Supplier ID	Price	Supplier Name	Quantity	Item Total
099	Basic Paint Set	S1	£3	Smith and Co	1	£3.00
0100	Sable Brush Set	S2	£3.50	Acro	1	£3.50
0101	Extended Colour Set	S1	£3.75	Smith and Co	3	£11.25
098	Metallic Paint Set	S1	£3.99	Smith and Co	1	£3.99
078	Mixed Brush Set	S2	£3.99	Acro	2	£7.98

Total: 29.72

The Entity Relationship Diagram


Physical Design (2) Topic 7 - 7.16
The Modified Entity Relationship Diagram
Customer
1
0...*
Order
1
0...*
OrderItem
0...*
1
Item
0...*
1
Supplier
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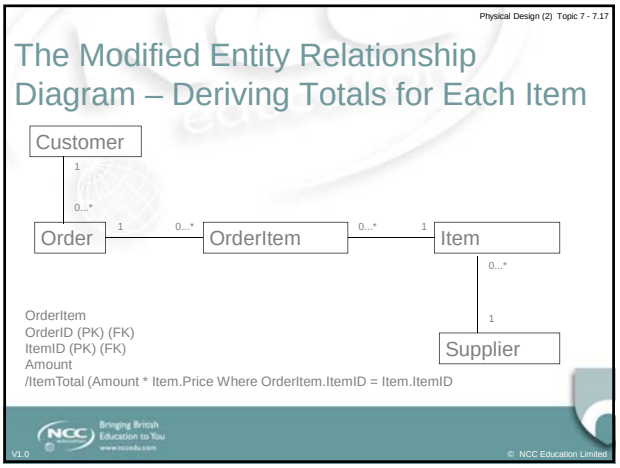
Physical Design (2) Topic 7 - 7.17
The Modified Entity Relationship Diagram – Deriving Totals for Each Item
Customer
1
0...*
Order
1
0...*
OrderItem
0...*
1
Item
0...*
1
Supplier
OrderItem
OrderID (PK) (FK)
ItemID (PK) (FK)
Amount
/ItemTotal (Amount * Item.Price Where OrderItem.ItemID = Item.ItemID
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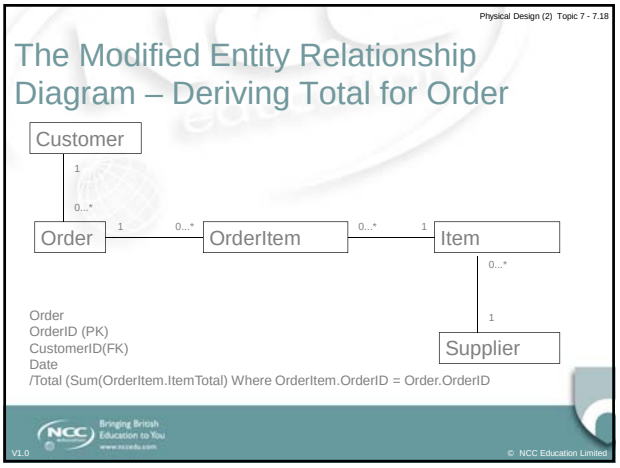
Physical Design (2) Topic 7 - 7.18
The Modified Entity Relationship Diagram – Deriving Total for Order
Customer
1
0...*
Order
1
0...*
OrderItem
0...*
1
Item
0...*
1
Supplier
Order
OrderID (PK)
CustomerID(FK)
Date
/Total (Sum(OrderItem.ItemTotal) Where OrderItem.OrderID = Order.OrderID
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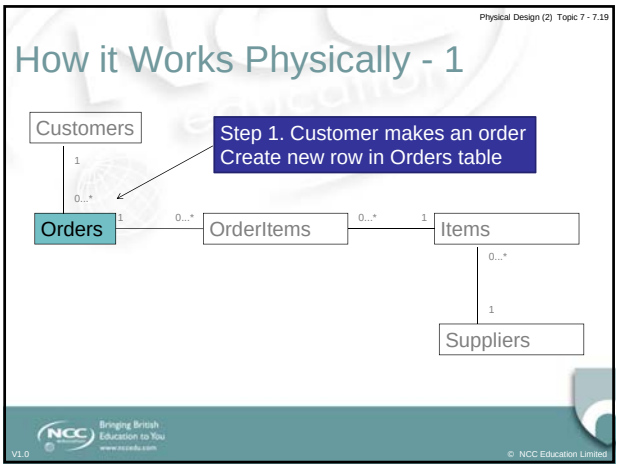
Physical Design (2) Topic 7 - 7.19
How it Works Physically - 1
Customers
Step 1. Customer makes an order
Create new row in Orders table
Orders
OrderItems
Items
Suppliers
1
0...*
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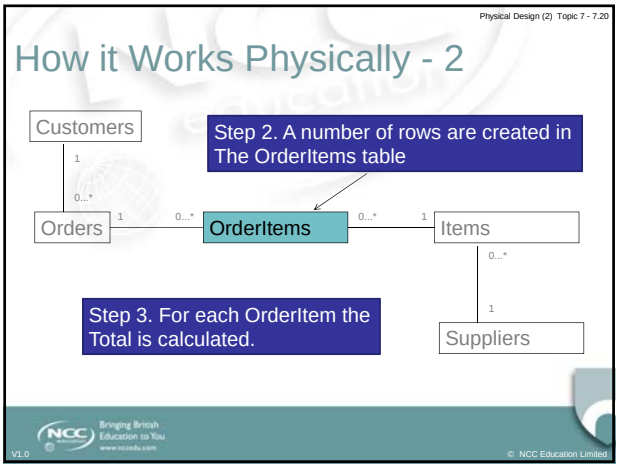
Physical Design (2) Topic 7 - 7.20
How it Works Physically - 2
Customers
Step 2. A number of rows are created in
The OrderItems table
Orders
OrderItems
Items
Step 3. For each OrderItem the
Total is calculated.
Suppliers
1
0...*
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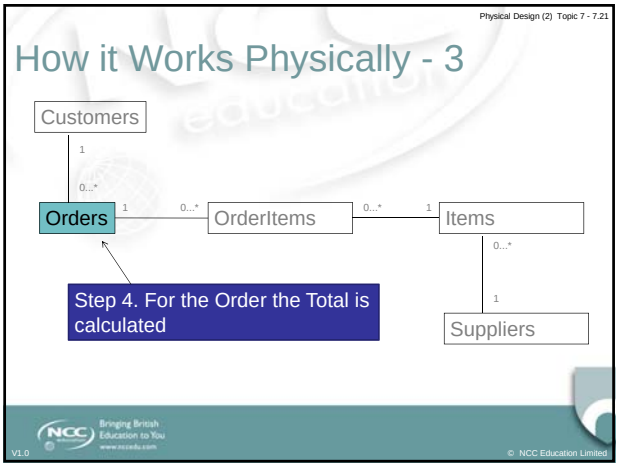
Physical Design (2) Topic 7 - 7.21
How it Works Physically - 3
Customers
Orders
OrderItems
Items
Step 4. For the Order the Total is
calculated
Suppliers
1
0...*
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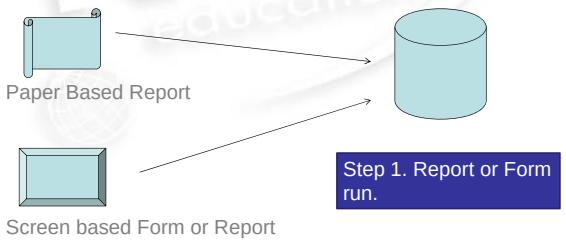
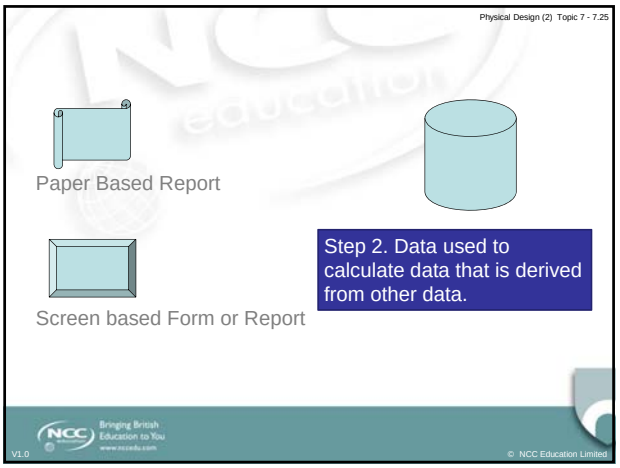
Overheads of Derived Data

- Additional storage of extra attribute
- New calculation every time a value in the source field is changed
- Possibility of data becoming inconsistant

Calculating at Run Time

- The Order Form and similar documents such as invoices and receipts would be created as applications
- The totals calculated as they are needed
- Totals not stored in database: no derived fields




Physical Design (2) Topic 7 - 7.25
Paper Based Report
Screen based Form or Report
Step 2. Data used to calculate data that is derived from other data.
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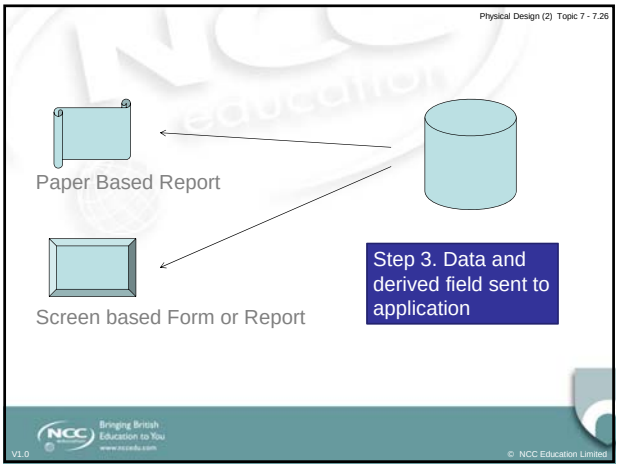
Physical Design (2) Topic 7 - 7.26
Paper Based Report
Screen based Form or Report
Step 3. Data and derived field sent to application
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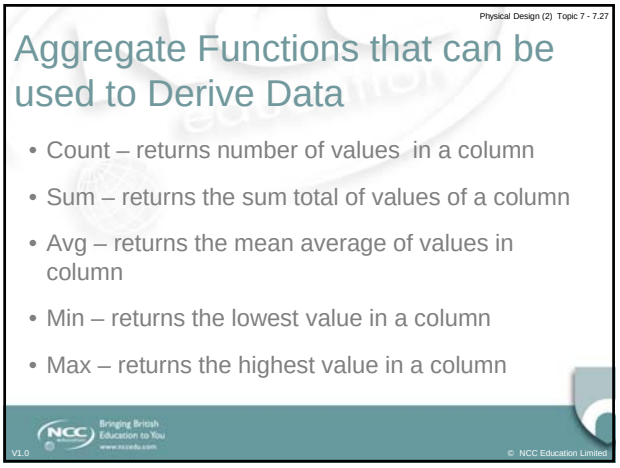
Physical Design (2) Topic 7 - 7.27
Aggregate Functions that can be used to Derive Data
• Count – returns number of values in a column
• Sum – returns the sum total of values of a column
• Avg – returns the mean average of values in column
• Min – returns the lowest value in a column
• Max – returns the highest value in a column
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Standard SQL for Derived Column in Create Table Statement

```
CREATE TABLE ProductsStock
(
...
Product_itemID INTEGER NOT NULL,
list_price DECIMAL(7,2) NOT NULL,
Quantity INTEGER NOT NULL,
stock_value GENERATED ALWAYS AS (Quanity *
list_price),
...
)
```


Example of Insert Statement with Derived Data

```
INSERT INTO employee_year_earnings
  SELECT employee_id, salary*12
  FROM employees;
```


Derived Attribute or Calculation at Run Time?

- How complicated is the calculation to be made?
- Does it involve multiple table joins and so could impact performance?
- How often would a derived attribute be updated? Could this affect performance.

Other Types of Derived Fields – Non Numeric

- Potentially any type of business rule could be used to derive data
- e.g. Items of a particular sort will all be the same colour
- Would need to used more complex embedded procedural logic such as a database trigger or macro

Learning Outcomes

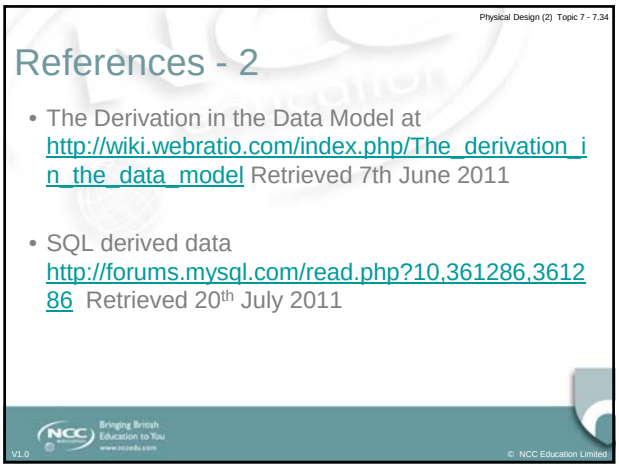
By the end of this unit students will be able to:

- Understand the concept of derived data
- Design a representation of derived data
- Recognise the tradeoffs between different ways of implementing derived data

Did we meet them?

References - 1

- Connolly, Thomas M., and Begg, Carolyn E., *Database Systems: A Practical Approach to Design and Implementation* Addision-Wesley, Fourth Edition 2005 Chapter 17
- Connolly, Thomas and Begg, Carolyn *Database Solutions: A step-by-step guide to building database* Addison-Wesley 2nd Edition 2004 Chapter 12


Physical Design (2) Topic 7 - 7.34
References - 2
• The Derivation in the Data Model at http://wiki.webratio.com/index.php/The_derivation_in_the_data_model Retrieved 7th June 2011
• SQL derived data http://forums.mysql.com/read.php?10,361286,361286 Retrieved 20th July 2011
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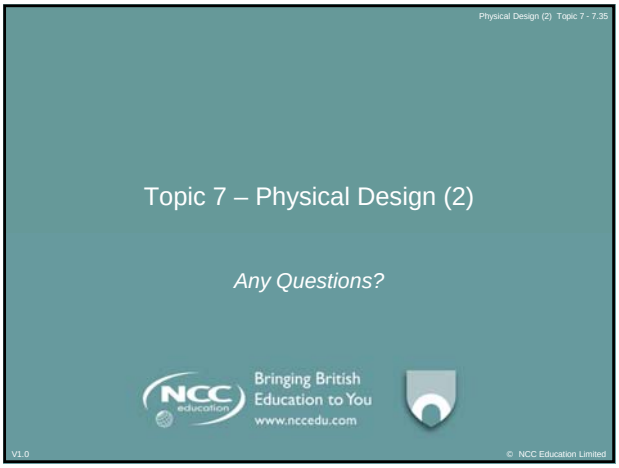
Physical Design (2) Topic 7 - 7.35
Topic 7 – Physical Design (2)
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