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INFORMATION
TECHNOLOGY
程序代写 代做 CS 编程辅导



FIT3003 – Business Intelligence and Data Warehousing

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Semester 2, 2021

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The screenshot shows a web browser window titled "FLUX" with the URL <https://flux.qa/#/feeds/5d368...>. The page is titled "Lecture 0". Below the title, there are four icons: a document, a person, a gift, and a clock. A section titled "Current Polls" is displayed, showing a single poll titled "Multiple Choice" with the question "What did you have for dinner?". The poll has five options: A) Pasta, B) Rice, C) Pizza, D) Salad, and E) Nothing.

Outline

程序代写代做 CS编程辅导

- Overview of Temporal Data Warehousing - A Bookshop Case Study
- Implementation of Temporal Dimensions
- Temporal Attributes
- Temporal Dimensions
- Slowly Changing Dimensions
 - SCD Type 0 and Type 1
 - SCD Type 2
 - SCD Type 3
 - SCD Type 4
 - SCD Type 6
- Implementation of SCD in SQL
- Creating the Fact Tables



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Temporal Data Warehouse

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- Temporal (or historical)  of records is incorporated into the data warehouse
 - E.g. keeping track of price changes over time
- Also known as  Slowly Changing Dimensions (SCD)

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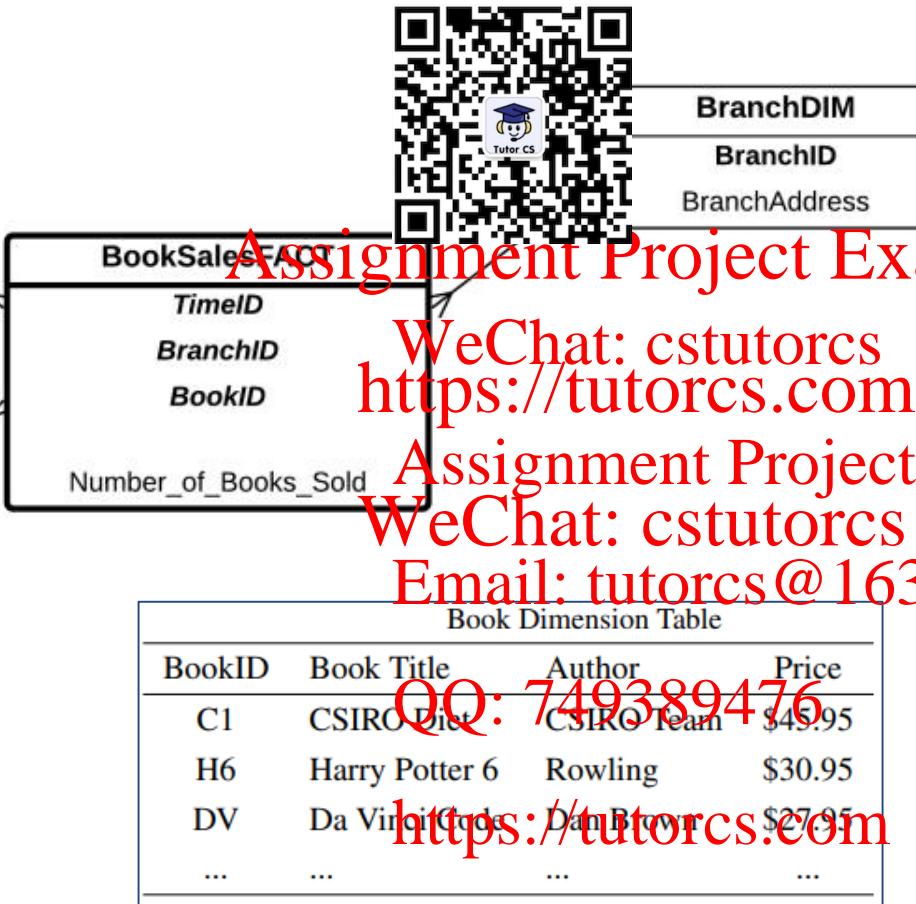
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A Bookshop Case Study

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TimeDIM
TimeID
Month
Year

BookDIM
BookID
BookTitle
Author
Price



BookSalesFact Table			
TimeID	BranchID	BookID	Number of Books Sold
Mar2008	City	C1	5
Mar2008	City	H6	15
Mar2008	City	DV	23
Mar2008	City
Mar2008	Chadstone	C1	15
Mar2008	Chadstone	H6	3
Mar2008	Chadstone	DV	2
Mar2008	Chadstone
Mar2008	Camberwell	C1	1
Mar2008	Camberwell	H6	1
Mar2008	Camberwell	DV	2
Mar2008	Camberwell
Mar2008
...
Dec2007	City	C1	15
Dec2007	City	H6	6
Dec2007	City	DV	6
Dec2007	City
Dec2007	Chadstone	C1	10
Dec2007	Chadstone	H6	8
Dec2007	Chadstone	DV	1
Dec2007	Chadstone
Dec2007	Camberwell	C1	18
Dec2007	Camberwell	H6	3
Dec2007	Camberwell	DV	2
Dec2007	Camberwell
Dec2007
...

A Bookshop Case Study - Report 1

Report (Book Sales Data with Book Dimensions)

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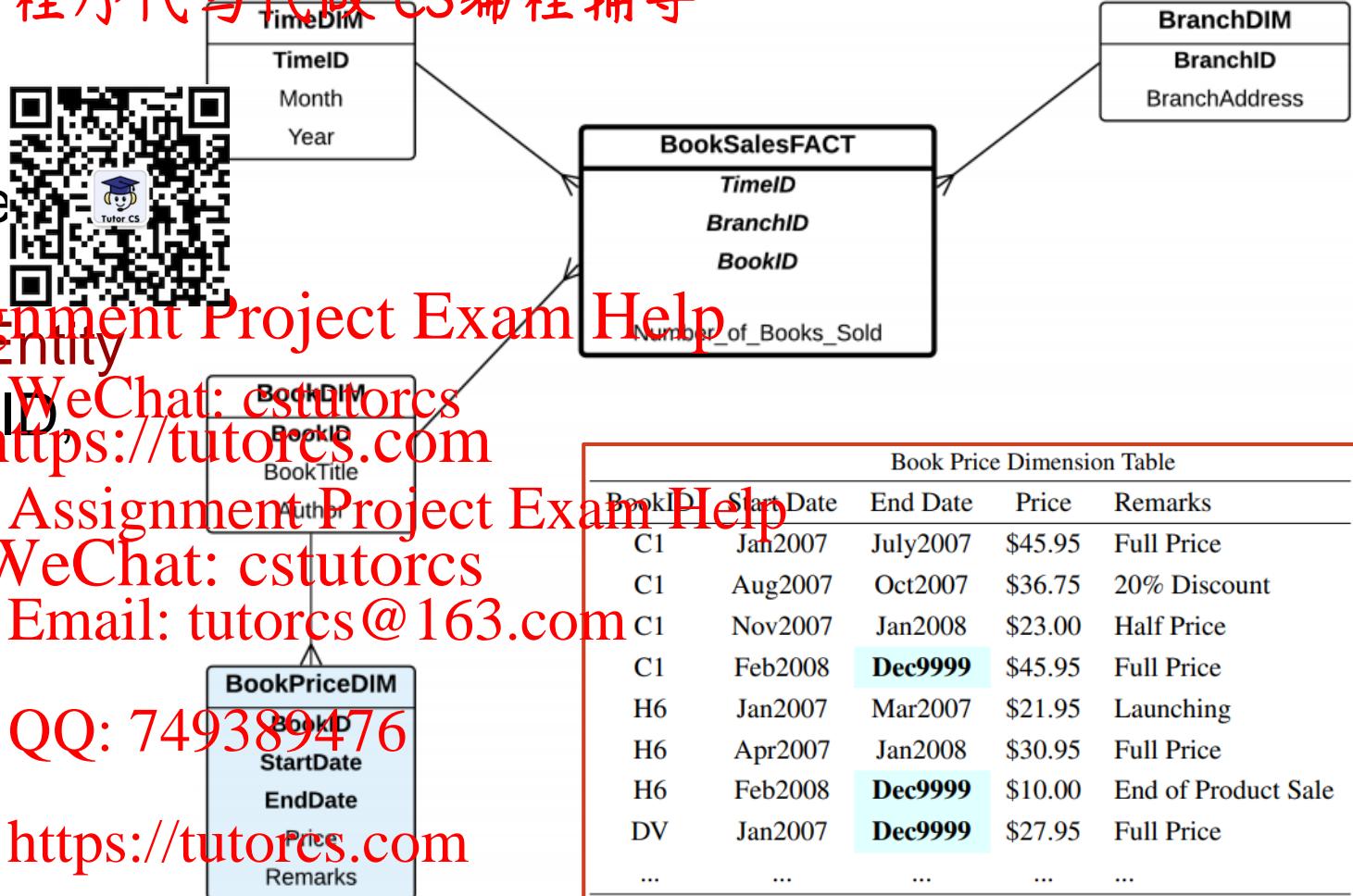
TimeID	BranchID	BookID	Book Title	Author	Price	Number of Books Sold
Mar2008	City		CSIRO Diet	CSIRO Team	\$45.95	5
Mar2008	City		Harry Potter 6	Rowling	\$30.95	15
Mar2008	City		Da Vinci Code	Dan Brown	\$27.95	23
Mar2008	City
Mar2008	Chadstone	C1	CSIRO Diet	CSIRO Team	\$45.95	15
Mar2008	Chadstone	H6	Harry Potter 6	Rowling	\$30.95	3
Mar2008	Chadstone	DV	Da Vinci Code	Dan Brown	\$27.95	2
Mar2008	Chadstone
Mar2008	Camberwell	C1	CSIRO Diet	CSIRO Team	\$45.95	1
Mar2008	Camberwell	H6	Harry Potter 6	Rowling	\$30.95	1
Mar2008	Camberwell	DV	Da Vinci Code	Dan Brown	\$27.95	2
Mar2008	Camberwell
Mar2008
...
...
Dec2007	City	C1	CSIRO Diet	CSIRO Team	\$45.95	15
Dec2007	City	H6	Harry Potter 6	Rowling	\$30.95	6
Dec2007	City	DV	Da Vinci Code	Dan Brown	\$27.95	6
Dec2007	City

A Bookshop Case Study - with Bridge Table

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- Use a bridge table, BookPriceDIM to store the history of book prices
- Implemented as a Weak Entity
 - Composite key: BookID, StartDate, EndDate

Book Dimension Table		
BookID	Book Title	Author
C1	CSIRO Diet	CSIRO Team
H6	Harry Potter 6	Rowling
DV	Da Vinci Code	Dan Brown
...



A Bookshop Case Study

- Report 2

- The correct sales price is indicated according to the TimeID
- Enables more accurate analyses

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Report 2 with the correct Book Price							
TimeID	BranchID	BookID	Book Title	Author	Price	Number of Books Sold	
Mar2008	City	C1	CSIRO Diet	CSIRO Team	\$45.95	5	
Mar2008	City	H6	Harry Potter 6	Rowling	\$10.00	15	
Mar2008	City	DV	Da Vinci Code	Dan Brown	\$27.95	23	
Mar2008	City
Mar2008	Chadstone	C1	CSIRO Diet	CSIRO Team	\$45.95	15	
Mar2008	Chadstone	H6	Harry Potter 6	Rowling	\$10.00	3	
Mar2008	Chadstone	DV	Da Vinci Code	Dan Brown	\$27.95	2	
Mar2008	Chadstone
Mar2008	Camberwell	C1	CSIRO Diet	CSIRO Team	\$45.95	1	
Mar2008	Camberwell	H6	Harry Potter 6	Rowling	\$10.00	1	
Mar2008	Camberwell	DV	Da Vinci Code	Dan Brown	\$27.95	2	
Mar2008	Camberwell
Mar2008
Dec2007	City	C1	CSIRO Diet	CSIRO Team	\$23.00	15	
Dec2007	City	H6	Harry Potter 6	Rowling	\$30.95	6	
Dec2007	City	DV	Da Vinci Code	Dan Brown	\$27.95	6	
Dec2007	City
Dec2007	Chadstone	C1	CSIRO Diet	CSIRO Team	\$23.00	10	
Dec2007	Chadstone	H6	Harry Potter 6	Rowling	\$30.95	8	
Dec2007	Chadstone	DV	Da Vinci Code	Dan Brown	\$27.95	1	
Dec2007	Chadstone
Dec2007	Camberwell	C1	CSIRO Diet	CSIRO Team	\$23.00	18	
Dec2007	Camberwell	H6	Harry Potter 6	Rowling	\$30.95	3	
Dec2007	Camberwell	DV	Da Vinci Code	Dan Brown	\$27.95	2	

Implementation of Temporal IDW



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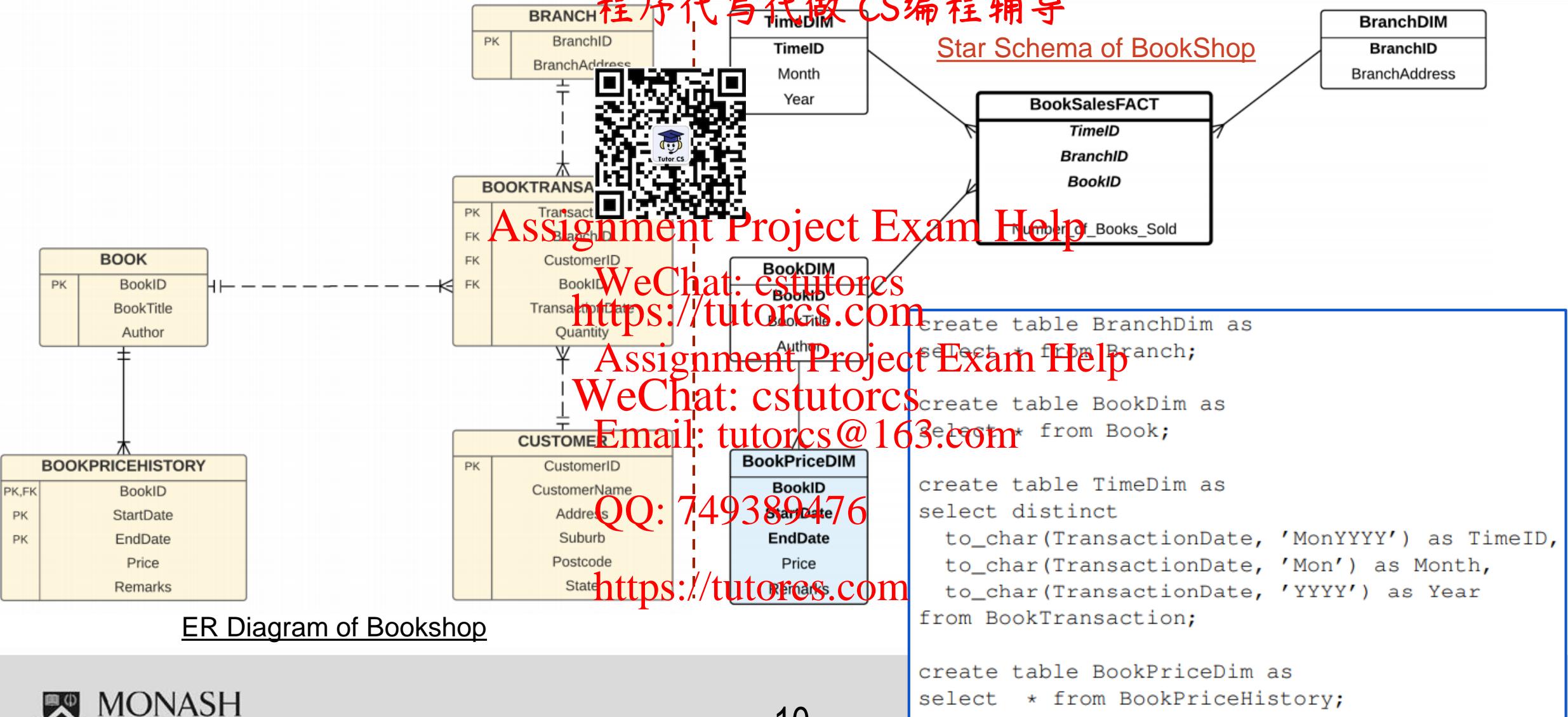
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Implementation of Temporal Data Warehousing

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Implementation of Temporal Data Warehousing - Creating Fact Table

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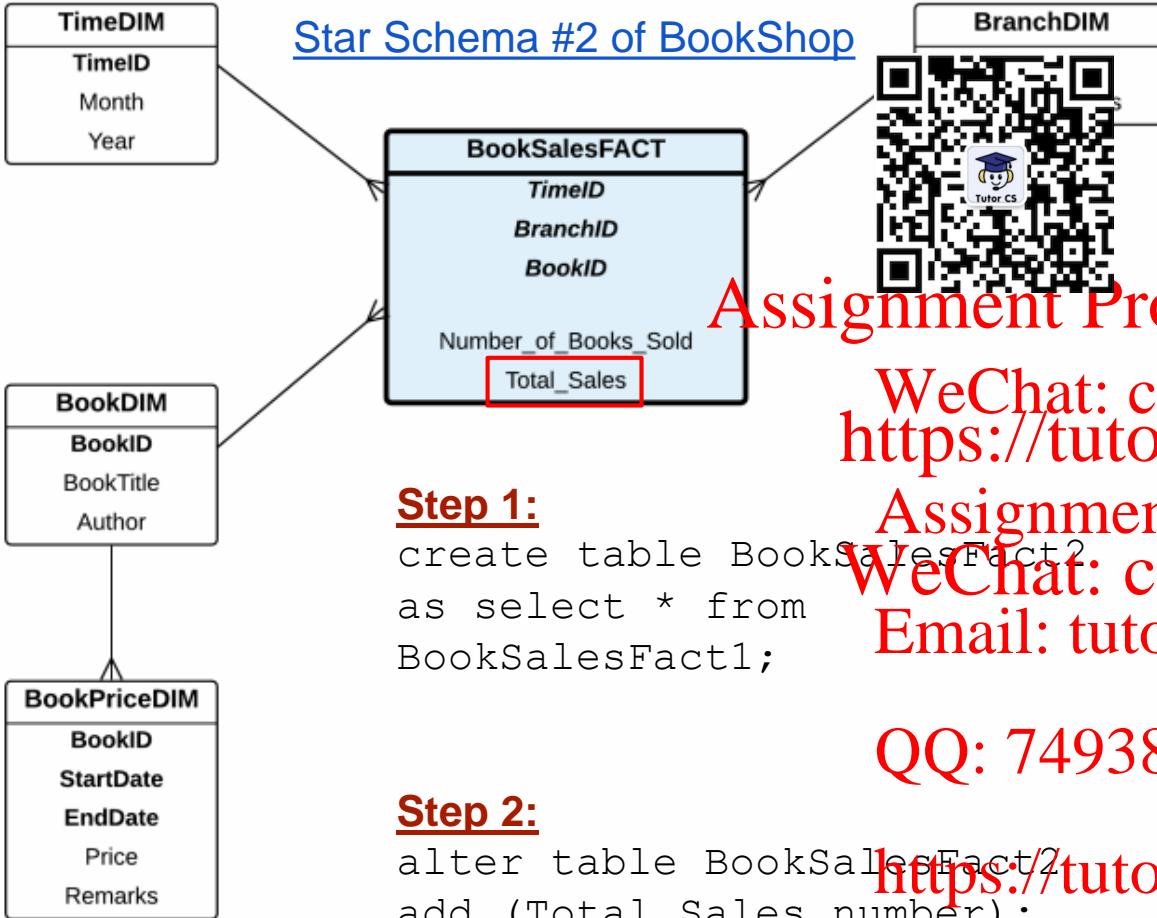
```
create table BookSalesFact
as
select to_char(T.TransactionDate, 'MonYYYY') as TimeID,
       BK.BookID, BR.BranchID,
       sum(T.Quantity) as Number_of_Books_Sold
  from BookTransaction T, Book BK, Branch BR
 where T.BranchID = BR.BranchID
   and T.BookID = BK.BookID
group by to_char(T.TransactionDate, 'MonYYYY'), BK.BookID,
         BR.BranchID;
```

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Implementation of Temporal Data Warehousing - Star Schema #2

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Step 1:

```
create table BookSalesFact2  
as select * from  
BookSalesFact1;
```

Step 2:

```
alter table BookSalesFact2  
add (Total_Sales number);
```

Step 3:

```
declare  
cursor PriceCursor is  
select * from BookPriceDim;  
begin  
for Item in PriceCursor loop  
    update value for Total_Sales in  
    -- BookSalesFact2  
    update BookSalesFact2  
    set Total_Sales =  
        Number_of_Books_Sold * Item.Price  
    where BookID = Item.BookID  
    and to_date(TimeID, 'MonYYYY') >=  
        to_date(Item.StartDate,  
        'MonYYYY')  
    and to_date(TimeID, 'MonYYYY') <=  
        to_date(Item.EndDate, 'MonYYYY');  
    end loop;  
end;
```

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Implementation of Temporal Data Warehousing - Star Schema #2 (cont.)

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```
-- if BookSalesFact1 has no created
create table BookSalesFact2
as
select to_char(T.TransactionDate, 'MonYYYY') as TimeID,
BK.BookID, BR.BranchID,
sum(T.Quantity) as NumberOfBooksSold,
sum(T.Quantity * BP.Price) as Total_Sales
from BookTransaction T, Book BK, Branch BR, BookPriceHistory BP
where T.BranchID = BR.BranchID
and T.BookID = BK.BookID
and BK.BookID = BP.BookID
and T.TransactionDate >= to_date(BP.StartDate, 'MonYYYY')
and T.TransactionDate <= to_date(BP.EndDate, 'MonYYYY')
group by to_char(T.TransactionDate, 'MonYYYY'), BK.BookID, BR.BranchID;
```



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Temporal Attributes

Temporal Attributes

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- Temporal attribute

- An attribute in which the value of that attribute has a life-span
- In this example, each price has a life-span, and it is determined by the *StartDate* and *EndDate* attributes in the *BookPriceDIM* table
- BookPriceDIM* table is WeChat implementation of a temporal data warehousing



Book Dimension Table		
BookID	Book Title	Author
C1	CSIRO Diet	CSIRO Team
H6	Harry Potter 6	Rowling
DV	Da Vinci Code	Dan Brown
...

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Book Price Dimension Table				
BookID	Start Date	End Date	Price	Remarks
C1	Jan2007	July2007	\$45.95	Full Price
C1	Aug2007	Oct2007	\$36.75	20% Discount
C1	Nov2007	Jan2008	\$23.00	Half Price
C1	Feb2008	Dec9999	\$45.95	Full Price
H6	Jan2007	Mar2007	\$21.95	Launching
H6	Apr2007	Jan2008	\$30.95	Full Price
H6	Feb2008	Dec9999	\$10.00	End of Product Sale
H6	Jan2007	Dec9999	\$27.95	Full Price
...

Generating Report 2

Report 2 with the correct Book Price						
TimeID	BranchID	BookID	Book Title	Author	Price	Number of Books Sold
Mar2008	City	C1	CSIRO Diet	CSIRO Team	\$45.95	5
Mar2008	City	H6	Harry Potter 6	Rowling	\$10.00	
Mar2008	City	DV	Da Vinci Code	Dan Brown	\$27.95	
Mar2008	City	
Mar2008	Chadstone	C1	CSIRO Diet	CSIRO Team	\$45.95	
Mar2008	Chadstone	H6	Harry Potter 6	Rowling	\$10.00	
Mar2008	Chadstone	DV	Da Vinci Code	Dan Brown	\$27.95	
Mar2008	Chadstone	
Mar2008	Camberwell	C1	CSIRO Diet	CSIRO Team	\$45.95	
Mar2008	Camberwell	H6	Harry Potter 6	Rowling	\$10.00	
Mar2008	Camberwell	DV	Da Vinci Code	Dan Brown	\$27.95	
Mar2008	Camberwell	
Mar2008	
...	
...	
Dec2007	City	C1	CSIRO Diet	CSIRO Team	\$23.00	15
Dec2007	City	H6	Harry Potter 6	Rowling	\$30.95	4
Dec2007	City	DV	Da Vinci Code	Dan Brown	\$27.95	6
Dec2007	City	
Dec2007	Chadstone	C1	CSIRO Diet	CSIRO Team	\$23.00	10
Dec2007	Chadstone	H6	Harry Potter 6	Rowling	\$30.95	8
Dec2007	Chadstone	DV	Da Vinci Code	Dan Brown	\$27.95	1
Dec2007	Chadstone	
Dec2007	Camberwell	C1	CSIRO Diet	CSIRO Team	\$23.00	18
Dec2007	Camberwell	H6	Harry Potter 6	Rowling	\$30.95	3
Dec2007	Camberwell	DV	Da Vinci Code	Dan Brown	\$27.95	2

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```
select
    F.TimeID,
    F.BranchID,
    F.BookID,
    B.BookTitle,
    B.Author,
    P.Price,
    F.Number_of_Books_Sold
  from BookSalesFact F, BookDim B, BookPriceDim P
 where F.BookID = B.BookID
   and B.BookID = P.BookID
   and to_date(F.TimeID, 'MonYYYY') >=
        to_date(P.StartDate, 'MonYYYY')
   and to_date(F.TimeID, 'MonYYYY') <=
        to_date(P.EndDate, 'MonYYYY');
```

A Bookshop Case Study - Potential Problem on Time Granularity

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BookID	Start Date	End Date	Remarks
C1	Jan2007	July2007	Full Price
C1	Aug2007	Oct2007	20% Discount
C1	Nov2007	15Jan2008	\$23.00 Half Price
C1	16Jan2008	Dec9999	\$45.95 Full Price
H6	Jan2007	Mar2007	\$21.95 Launching
H6	Apr2007	Jan2008	\$30.95 Full Price
H6	Feb2008	Dec9999	\$10.00 End of Product Sale
DV	Jan2007	Dec9999	\$27.95 Full Price
...



Bookshop Example



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TimeID = Jan2007

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```
and to_date(F.TimeID, 'MonYYYY') >=
to_date(P.StartDate, 'MonYYYY')
and to_date(F.TimeID, 'MonYYYY') <=
to_date(P.EndDate, 'MonYYYY');
```

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A Bookshop Case Study - Incorrect Report 3

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Report 3 – An Incorrect Report

TimeID	BranchID	BookID	Book Title	Author	Price	Number of Books Sold
Jan2008	City	C1	CSIRO Diet	CSIRO Team	\$23.00	25
Jan2008	City	C1	CSIRO Diet	CSIRO Team	\$45.95	25
Jan2008	City	H6	Harry Potter 6	Rowling	\$30.95	10
Jan2008	City	DV	Da Vinci Code	Dan Brown	\$27.95	7
Jan2008	City
Jan2008	Chadstone	C1	CSIRO Diet	CSIRO Team	\$23.00	30
Jan2008	Chadstone	C1	CSIRO Diet	CSIRO Team	\$45.05	30
Jan2008	Chadstone	H6	Harry Potter 6	Rowling	\$30.95	15
Jan2008	Chadstone	DV	Da Vinci Code	Dan Brown	\$27.95	5
Jan2008	Chadstone
Jan2008	Camberwell	C1	CSIRO Diet	CSIRO Team	\$23.00	20
Jan2008	Camberwell	C1	CSIRO Diet	CSIRO Team	\$45.05	20
Jan2008	Camberwell	H6	Harry Potter 6	Rowling	\$30.95	5
Jan2008	Camberwell	DV	Da Vinci Code	Dan Brown	\$27.95	5
Jan2008	Camberwell
Jan2008
...

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A Bookshop Case Study - Solving the Problem of Report 3

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- Display "two" prices on the same record in the report.

Report 4 – multiple book prices on one month					
TimeID	BranchID	BookID	Book Title	Author	Price
Jan2008	City	C1	CSIRO Diet	CSIRO Team	\$23.00;\$45.95
Jan2008	City	H6	Harry Potter 6	Rowling	\$30.95
Jan2008	City	DV	Da Vinci Code	Dan Brown	\$27.95
Jan2008	City
Jan2008	Chadstone	C1	CSIRO Diet	CSIRO Team	\$23.00;\$45.95
Jan2008	Chadstone	H6	Harry Potter 6	Rowling	\$30.95
Jan2008	Chadstone	DV	Da Vinci Code	Dan Brown	\$27.95
Jan2008	Chadstone
Jan2008	Camberwell	C1	CSIRO Diet	CSIRO Team	\$23.00;\$45.95
Jan2008	Camberwell	H6	Harry Potter 6	Rowling	\$30.95
Jan2008	Camberwell	DV	Da Vinci Code	Dan Brown	\$27.95
Jan2008	Camberwell
...



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What about *Total_Sales*?

```
select
    F.TimeID,
    F.BranchID,
    F.BookID,
    B.BookTitle,
    B.Author,
    listagg(P.Price, ',') within group (order by P.Price)
        as Price,
    F.Number_of_Books_Sold
from BookSalesFact F, BookDim B, BookPriceDim P
where F.BookID = B.BookID
    and B.BookID = P.BookID
    and to_date(F.TimeID, 'MonYYYY') >=
        to_date(P.StartDate, 'MonYYYY')
    and to_date(F.TimeID, 'MonYYYY') <=
        to_date(P.EndDate, 'MonYYYY')
group by
    F.TimeID,
    F.BranchID,
    F.BookID,
    B.BookTitle,
    B.Author,
    F.Number_of_Books_Sold;
```

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Temporal Dimensions

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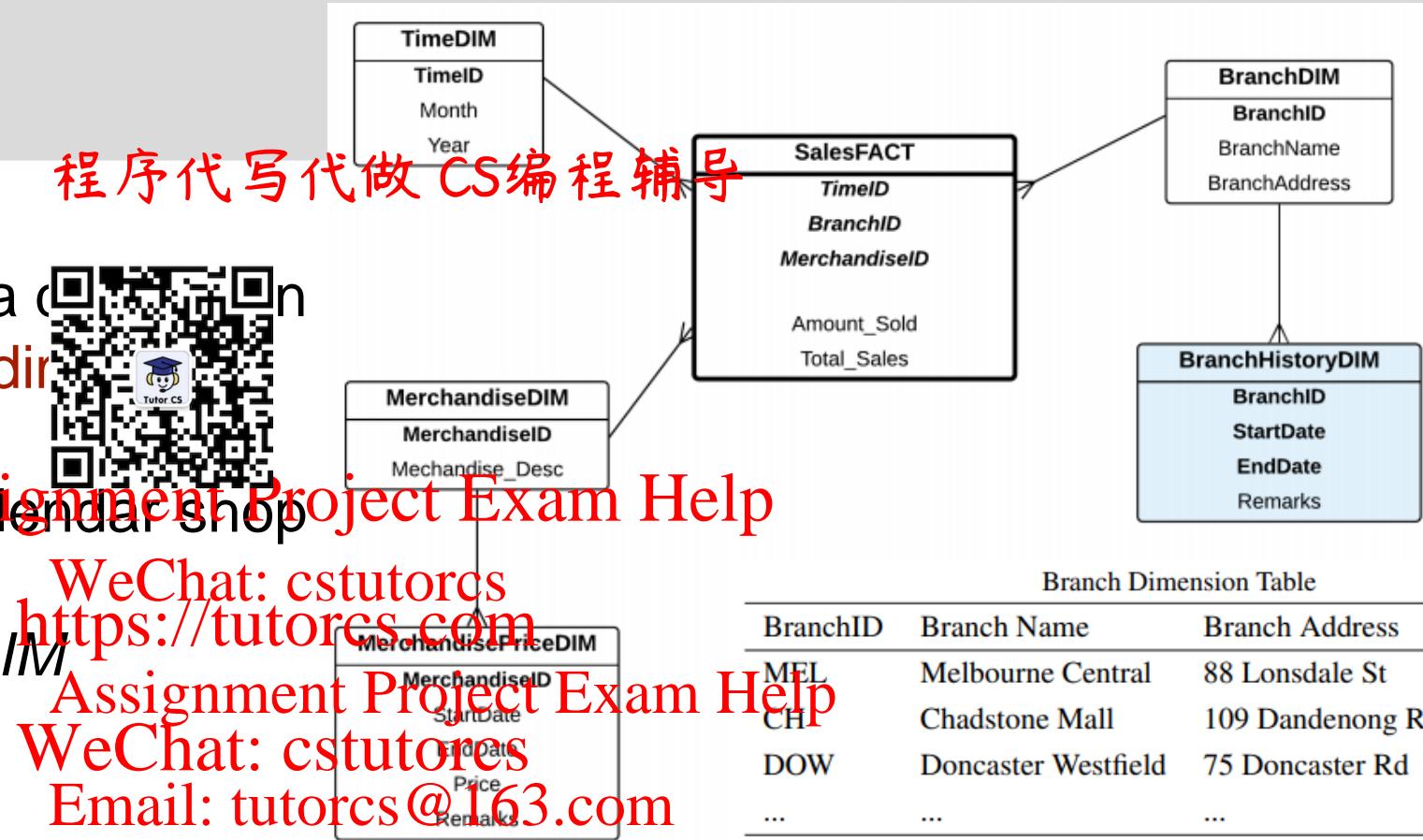
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Temporal Dimensions

- Temporal Dimension is a dimension where the record of the dimension has a specific life span.
 - Case study: a mobile calendar application
 - Temporal attribute
 - *MerchandisePriceDIM*
 - Temporal dimension:
 - *BranchHistoryDIM*



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BranchHistoryDim Table				
BookID	Start Date	End Date	Remarks	Contact Number
MEL	Jan0000	Dec9999	Main shop	(03) 9859 8070
CH	Oct2007	Mar2008		0411 848 821
CH	Oct2008	Feb2009	Under re-construction	0413 356 665
CH	Oct2009	Feb2010		0412 313 313
DOW	Nov2007	Feb2008		0427 123 456
DOW	Nov2008	Feb2009		0427 123 456
DOW	Oct2009	Feb2010		0427 123 456
...

A Mobile Calendar Shop - A Report

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Report - SalesFact joined with Branch Dimension and Branch History dimension

TimeID	BranchID	Branch Name	Branch Address	Start Date	End Date	Remarks	ContactNo	Merchand	Amount	TotSales
Oct2007	MEL	Melbourne Central	88 Lonsdale St	Oct2007	Dec9999	Main shop
Oct2007	CH	Chadstone Mall	109 Dandenong Rd	Oct2007	Mar2008	
Nov2007	MEL	Melbourne Central	88 Lonsdale St	Oct2007	Dec9999	Main shop
Nov2007	CH	Chadstone Mall	109 Dandenong Rd	Oct2007	Mar2008	
Nov2007	DOW	Doncaster Westfield	75 Doncaster Rd	Oct2007	Feb2008	
Dec2007	MEL	Melbourne Central	88 Lonsdale St	Jan0000	Dec9999	Main shop
Dec2007	CH	Chadstone Mall	109 Dandenong Rd	Oct2007	May2008	
Dec2007	DOW	Doncaster Westfield	75 Doncaster Rd	Nov2007	Feb2008	
Jan2008	MEL	Melbourne Central	88 Lonsdale St	Jan0000	Dec9999	Main shop
Jan2008	CH	Chadstone Mall	109 Dandenong Rd	Oct2007	Mar2008	
Jan2008	DOW	Doncaster Westfield	75 Doncaster Rd	Nov2007	Feb2008	
Feb2008	MEL	Melbourne Central	88 Lonsdale St	Jan0000	Dec9999	Main shop
Feb2008	CH	Chadstone Mall	109 Dandenong Rd	Oct2007	Mar2008	
Feb2008	DOW	Doncaster Westfield	75 Doncaster Rd	Nov2007	Feb2008	
Mar2008	MEL	Melbourne Central	88 Lonsdale St	Jan0000	Dec9999	Main shop
Mar2008	CH	Chadstone Mall	109 Dandenong Rd	Oct2007	Mar2008	
Apr2008	MEL	Melbourne Central	88 Lonsdale St	Jan0000	Dec9999	Main shop
May2008	MEL	Melbourne Central	88 Lonsdale St	Jan0000	Dec9999	Main shop
...
Oct2008	MEL	Melbourne Central	88 Lonsdale St	Jan0000	Dec9999	Main shop
Oct2008	CH	Chadstone Mall	109 Dandenong Rd	Oct2008	Feb2009	Under re-construction
...



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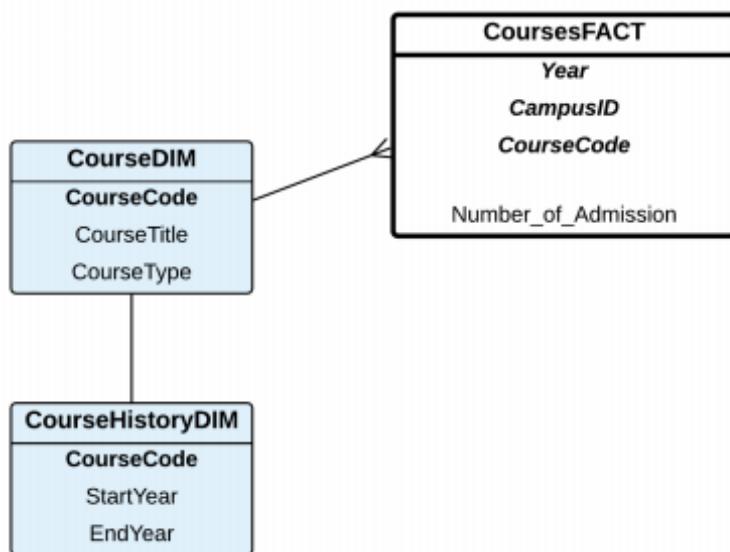
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Another Temporal Dimension

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- Course History as a Temporal Dimension – Using a Bridge Table
- Because the relationship between Course and Course History is a 1-1 relationship, both dimensions can be combined into one dimension, called the Course dimension.



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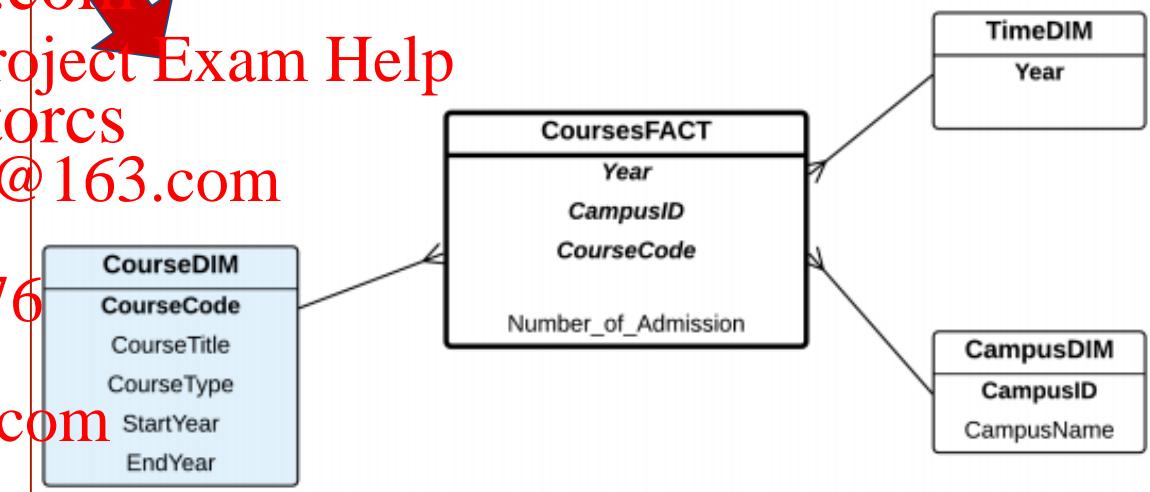
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Slowly Changing Dimensions (SCD)



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Slowly Changing Dimensions (SCD)

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- Slowly changing dimensions
 - Dimensions where the values of these dimensions **change slowly over a period of time**
 - E.g. Book dimension
 - It has price information, and it is common that the price of a book changes "slowly" over time
- Different from attributes/records that change 'rapidly', e.g. share price, location of a taxi
 - These are related to real-time data warehousing (stream data warehousing)



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Slowly Changing Dimensions (SCD) - Type 0 and Type 1

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- Both types do not actually record the history of changes in the dimension
- Type 0
 - The dimension stores “Original or Initial” value of the records, when the data warehousing
 - E.g. full price of books will be recorded in the book dimension
- Type 1
 - It only records the latest value of the record
 - E.g. the latest price of books will be recorded in the book dimension



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Book Dimension Table (SCD Type 0)			
BookID	Book Title	Author	Price
C1	CSIRO Diet	CSIRO Team	\$45.95
H6	Harry Potter 6	Rowling	\$30.95
DV	Da Vinci Code	Dan Brown	\$27.95
...

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Book Dimension Table (SCD Type 1)			
BookID	Book Title	Author	Price
C1	CSIRO Diet	CSIRO Team	\$45.95
H6	Harry Potter 6	Rowling	\$10.00
DV	Da Vinci Code	Dan Brown	\$27.95
...

Slowly Changing Dimensions (SCD) - Type 2

程序代写代做 CS编程辅导

- Type 2
 - Keeps track of the history in the main dimension
 - E.g. when the price of a book is changed, “another book” with the same details is created, with a new Book ID, and the new price



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Book Dimension Table (SCD Type 2)

BookDIM
BookID
BookTitle
Author
StartDate
EndDate
Price
Remarks
CurrentFlag

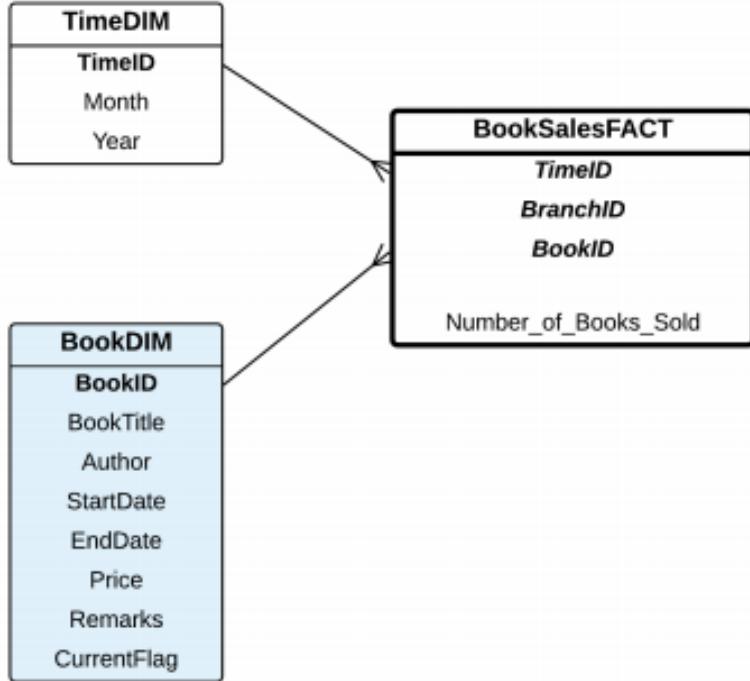
BookID	Book Title	Author	Start Date	End Date	Price	Remarks	Current Flag
C1_1	CSIRO Diet	CSIRO Team	Jan2007	July2007	\$45.95	Full Price	N
C1_2	CSIRO Diet	CSIRO Team	Aug2007	Oct2007	\$36.75	20% Discount	N
C1_3	CSIRO Diet	CSIRO Team	Nov2007	Jan2008	\$23.00	Half Price	N
C1_4	CSIRO Diet	CSIRO Team	Feb2008	Dec9999	\$45.95	Full Price	Y
H6_1	Harry Potter 6	Rowling	Jan2007	Mar2007	\$21.95	Launching	N
H6_2	Harry Potter 6	Rowling	Apr2007	Jan2008	\$30.95	Full Price	N
H6_3	Harry Potter 6	Rowling	Feb2008	Dec9999	\$10.00	End of Product Sale	Y
DV_1	Da Vinci Code	Dan Brown	Jan2007	Dec9999	\$27.95	Full Price	Y
...

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Slowly Changing Dimensions (SCD) Type 2 (cont.)

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TimeID	BranchID	BookID	Book Title	Author	Price	Number of Books Sold
Mar2008	City	C1_4	CSIRO Diet	CSIRO Team	\$45.95	5
Mar2008	City	H6_3	Harry Potter 6	Rowling	\$10.00	15
Mar2008	City	DV_1	Da Vinci Code	Dan Brown	\$27.95	23
Mar2008	City
Mar2008	Chadstone	C1_4	CSIRO Diet	CSIRO Team	\$45.95	15
Mar2008	Chadstone	H6_3	Harry Potter 6	Rowling	\$10.00	3
Mar2008	Chadstone	DV_1	Da Vinci Code	Dan Brown	\$27.95	2
Mar2008	Chadstone
Mar2008	Camberwell	C1_4	CSIRO Diet	CSIRO Team	\$45.95	1
Mar2008	Camberwell	H6_3	Harry Potter 6	Rowling	\$10.00	1
Mar2008	Camberwell	DV_1	Da Vinci Code	Dan Brown	\$27.95	2
Mar2008	Camberwell
Mar2008
Dec2007	City	C1_3	CSIRO Diet	CSIRO Team	\$23.00	15
Dec2007	City	H6_2	Harry Potter 6	Rowling	\$30.95	6
Dec2007	City	DV_1	Da Vinci Code	Dan Brown	\$27.95	6
Dec2007	City
Dec2007	Chadstone	C1_3	CSIRO Diet	CSIRO Team	\$23.00	10
Dec2007	Chadstone	H6_2	Harry Potter 6	Rowling	\$30.95	8
Dec2007	Chadstone	DV_1	Da Vinci Code	Dan Brown	\$27.95	1
Dec2007	Chadstone
Dec2007	Camberwell	C1_3	CSIRO Diet	CSIRO Team	\$23.00	18
Dec2007	Camberwell	H6_2	Harry Potter 6	Rowling	\$30.95	3
Dec2007	Camberwell	DV_1	Da Vinci Code	Dan Brown	\$27.95	2
Dec2007	Camberwell
Dec2007

Slowly Changing Dimensions (SCD) - Type 3

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- Type 3
 - Simplification of Type 2
 - Maintains only the current values, not the entire history
 - E.g. only the last two prices of the book are recorded
 - Rationale
 - Assume that analyses of complete history is not necessary
 - Most analyses will be done on the current price, and at most one past price, e.g. for comparison with the trend



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Slowly Changing Dimensions (SCD) - Type 3 (cont.)

程序代写代做 CS 编程辅导
Book Dimension Table (SCD Type 3)

BookID	Book Title	Author	Current Price	Previous Price
C1	CSIRO D	CSIRO Team	\$45.95	\$23.00
H6	Harry Po	J.K. Rowling	\$10.00	\$30.95
DV	Da Vinci	Brown	\$27.95	Null
...

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TimeDIM
TimelD
Month
Year



BookDIM
BookID
BookTitle
Author
CurrentPrice
PreviousPrice

Slowly Changing Dimensions (SCD) - Type 4

程序代写代做 CS编程辅导

- Type 4
 - Create a new dimension to maintain the history of attribute value change
 - E.g. *BookPriceDIM* in [Assignment Project Exam Help](#)
 - Main advantage:
 - Do not need to have a different *BookID* for the same book.



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Book Dimension Table		
BookID	Book Title	Author
C1	CSIRO Diet	CSIRO Team
H6	Harry Potter 6	Rowling
DV	Da Vinci Code	Dan Brown
...

Book Price Dimension Table				
BookID	Start Date	End Date	Price	Remarks
C1	Jan2007	July2007	\$45.95	Full Price
C1	Aug2007	Oct2007	\$36.75	20% Discount
C1	Nov2007	Jan2008	\$23.00	Half Price
C1	Feb2008	Dec9999	\$45.95	Full Price
H6	Jan2007	Mar2007	\$21.95	Launching
H6	Apr2007	Jan2008	\$30.95	Full Price
H6	Feb2008	Dec9999	\$10.00	End of Product Sale
DV	Jan2007	Dec9999	\$27.95	Full Price
...

Slowly Changing Dimensions (SCD) - Type 6

程序代写代做 CS编程辅导

- Type 6
 - Combination of Type 2 and Type 3
 - A separate identifier for each dimension (BookID) is needed, the book is not needed (Type 3), but the entire history (BookTitle, Author, StartDate, EndDate) is stored (Type 2)



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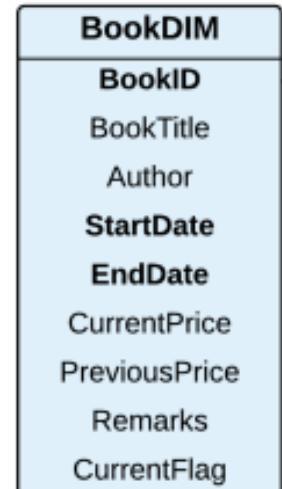
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Book Dimension SCD Type 6								
BookID	Book Title	Author	Start Date	End Date	Current Price	Previous Price	Remarks	Current Flag
C1	CSIRO Diet	CSIRO Team	Jan2007	July2007	\$45.95	Null	Full Price	N
C1	CSIRO Diet	CSIRO Team	Aug2007	Oct2007	\$36.75	\$45.95	20% Discount	N
C1	CSIRO Diet	CSIRO Team	Nov2007	Jan2008	\$25.00	\$36.75	Half Price	N
C1	CSIRO Diet	CSIRO Team	Feb2008	Dec9999	\$45.00	\$25.00	Full Price	Y
H6	Harry Potter 6	Rowling	Jan2007	Mar2007	\$21.95	Null	Launching	N
H6	Harry Potter 6	Rowling	Apr2007	Jan2008	\$34.00	\$21.95	Full Price	N
H6	Harry Potter 6	Rowling	Feb2008	Dec9999	\$10.00	\$30.95	End of Product Sale	Y
DV	Da Vinci Code	Dan Brown	Jan2007	Dec9999	\$27.95	Null	Full Price	Y
...



Composite key
{BookID, StartDate,
EndDate}

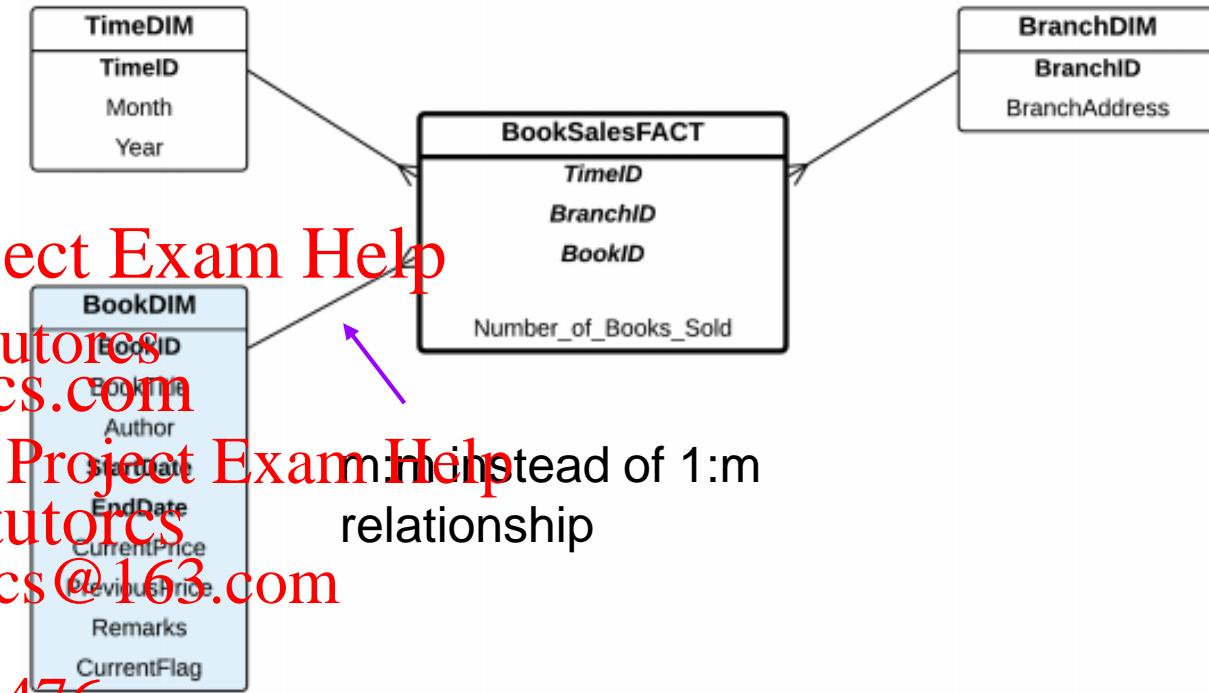
Slowly Changing Dimensions (SCD) - Type 6 (cont.)

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- Type 6
 - m:m relationship between *BookDIM* and *BookSale*



- Solution #1:
 - Add new surrogate key to Book Dimension table (Type 2)
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 - Consequently, the Fact table will have this surrogate key from the Book Dimension as a reference.
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 - The surrogate key can also simply be a concatenation between *BookID*, *StartDate*, and *EndDate*, or, *BookID* with a sequence number
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Slowly Changing Dimensions (SCD) - Type 6 (cont.)

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- **Solution #2:**

- Include the *StartDate* and *EndDate* in the fact table
 - Messy because the fact table already has TimeID

- **Solution #3:**

- Add an associative table (or a bridge table) between Book Dimension and the fact table
 - The associative table will have a composite key comprising key identifier from Book dimension and from the fact table
 - Messy as well

- **Conclusion:**

- Solution #1 is the best: ~~QQ: 749389476~~
 - So Type 6 is rather unnecessary!



Implementation of SCD in SQL

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Implementation of SCD in SQL - Type 0

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Book (BookID, BookTitle, Author)



BookPriceHistory (BookID, StartDate, EndDate, Price, Remarks)

Book Dimension Table (SCD Type 0)			
BookID	Book Title	Author	Price
C1	CSIRO Diet	CSIRO Team	\$45.95
H6	Harry Potter 6	Rowling	\$30.95
DV	Da Vinci Code	Dan Brown	\$27.95
...

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-- Non-temporal dimension WeChat: cstutorcs

create table SCD0

as

select distinct B.BookID, B.BookTitle, B.Author,

H.Price as OriginalPrice

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from Book B, BookPriceHistory H

where B.BookID = H.BookID and H.Remarks = 'Full Price';

Implementation of SCD in SQL - Type 1

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```
-- Latest price  
create table SCD1  
as  
select T.BookID, T.BookTitle, T.Author, T.Price as CurrentPrice  
from (  
    select B.BookID, B.BookTitle, H.Author,  
        to_date(H.StartDate, 'MonYYYY'), H.Price,  
        rank() over( partition by B.BookID order by  
            to_date(H.StartDate, 'MonYYYY') desc) as Rank  
    from Book B, BookPriceHistory H where B.BookID = H.BookID) T  
where T.Rank = 1;
```



Book Dimension Table (SCD Type 1)			
BookID	Book Title	Author	Price
C1	CSIRO Diet	CSIRO Team	\$45.95
H6	Harry Potter 6	Rowling	\$10.00
DV	Da Vinci Code	Dan Brown	\$27.95
...

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Implementation of SCD in SQL - Type 2

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```
-- New BookID for every changed price
```

```
create table SCD2
```

```
as
```

```
select B.BookID || '_' ||  
       rank() over(partition by B.BookID  
                  order by H.StartDate Mon YYYY asc) as BookID,  
       B.BookTitle, B.Author, H.StartDate, H.EndDate, H.Price, H.Remarks,  
       case H.EndDate  
           When 'Dec9999' then 'Y'  
           else 'N'  
       end as CurrentFlag  
  from Book B, BookPriceHistory H  
 where B.BookID = H.BookID;
```



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Book Dimension Table (SCD Type 2)								
BookID	Book Title	Author	Start Date	End Date	Price	Remarks	Current Flag	
C0_1	CSIRO Diet	CSIRO Team	Jan2007	July2007	\$45.95	Full Price	N	
C1_2	CSIRO Diet	CSIRO Team	Aug2007	Oct2007	\$36.75	20% Discount	N	
C1_3	CSIRO Diet	CSIRO Team	Nov2007	Jan2008	\$23.00	Half Price	N	
H1_1	CSIRO Diet	CSIRO Team	Feb2008	Dec9999	\$45.95	Full Price	Y	
H6_1	Harry Potter 6	Rowling	Jan2007	Mar2007	\$21.95	Launching	N	
H6_2	Harry Potter 6	Rowling	Apr2007	Jan2008	\$30.95	Full Price	N	
H6_3	Harry Potter 6	Rowling	Feb2008	Dec9999	\$10.00	End of Product Sale	Y	
DV_1	Da Vinci Code	Dan Brown	Jan2007	Dec9999	\$27.95	Full Price	Y	
...

Implementation of SCD in SQL - Type 3

-- Include current and previous price using outer join

create table SCD3

as

```
select T1.BookID, T1.BookTitle, T1.Author, T1.CurrentPrice, T2.CurrentPrice as PreviousPrice  
from  
(select T.BookID, T.BookTitle, T.Author, T.Price as CurrentPrice from (  
    select B.BookID, B.BookTitle, B.Author, to_date(H.StartDate, 'MonYYYY'), H.Price,  
    rank() over(partition by B.BookID order by to_date(H.StartDate, 'MonYYYY')  
               desc) as Rank  
from Book B, BookPriceHistory H  
where B.BookID = H.BookID) T  
where T.Rank = 1) T1,  
(select T.BookID, T.BookTitle, T.Author, T.Price as CurrentPrice from (  
    select B.BookID, B.BookTitle, B.Author, to_date(H.StartDate, 'MonYYYY'), H.Price,  
    rank() over(partition by B.BookID order by to_date(H.StartDate, 'MonYYYY')  
               desc) as Rank  
from Book B, BookPriceHistory H  
where B.BookID = H.BookID) T  
where T.Rank = 2) T2  
where T1.BookID = T2.BookID(+); -- Use outer join as some books do not have previous price
```

Book Dimension Table (SCD Type 3)				
BookID	Book Title	Author	Current Price	Previous Price
C1	CSIRO Diet	CSIRO Team	\$45.95	\$23.00
H6	Harry Potter 6	Rowling	\$10.00	\$30.95
DV	Da Vinci Code	Dan Brown	\$27.95	Null
...



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Implementation of SCD in SQL - Type 4

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- Type 4: Same as the Temporal Data Warehousing implementation

```
create table SCD4  
select * from Book
```



story;

Assignment Project Exam Help						Book Price Dimension Table
BOOKPRICEHISTORY		BookID	Start Date	End Date	Price	Remarks
PK,FK	BookID	C1	Jan2007	July2007	\$45.95	Full Price
PK	StartDate	C1	Aug2007	Oct2007	\$36.75	20% Discount
PK	EndDate	C1	Nov2007	Jan2008	\$23.00	Half Price
	Price	C1	Feb2008	Dec9999	\$45.95	Full Price
	Remarks	H6	Jan2007	Mar2007	\$21.95	Launching
		H6	Apr2007	Jan2008	\$30.95	Full Price
		H6	Feb2008	Dec9999	\$10.00	End of Product Sale
		DV	Jan2007	Dec9999	\$27.95	Full Price
	

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Implementation of SCD in SQL - Type 6 (Updated)

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- Type 6: Combination of SCD2 (use different Book ID) and SCD3 (current and previous values)
- SCD Type 2 identifier (Book ID) is different from the original Book ID used by SCD Type 3
 - Cannot simply use an equijoin between SCD Type 2 and SCD Type 3
 - Instead, check if the Book ID of SCD Type 3 is part of the Book ID of the SCD Type 2, using the like operator in SQL:

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Implementation of SCD in SQL - Type 6 (cont.) (Updated)

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```
create table SCD6 as
SELECT T1.BOOK_ID, T1.Book_Title, T1.Author,
       To_Char(T1.Start_Date, 'MonYYYY') AS Start_Date, To_Char(T1.End_Date, 'MonYYYY') AS End_Date,
       T1.Price AS Current_Price, T2.Previous_Price, T1.Remarks, SCD2.CurrentFlag
FROM
(SELECT SCD3.Book_ID, SCD3.BookTitle, SCD3.Author, H.Start_Date, H.End_Date, H.Price,
       (row_number() over (order by H.Start_Date desc)) as Head, H.Remarks
    FROM SCD3, Book_Price_History H
   WHERE SCD3.Book_ID = H.Book_ID) T1,
(SELECT SCD3.Book_ID, H.Price, (row_number() over (order by H.Start_Date desc))-1) as Tail
    FROM SCD3, Book_Price_History H
   WHERE SCD3.Book_ID = H.Book_ID) T2, SCD2
WHERE T1.Head = T2.Tail (+)
AND T1.Remarks = SCD2.Remarks AND SCD2.Book_ID like T1.Book_ID||'_%'
AND SCD2.End_Date = T1.End_Date
ORDER BY T1.Start_Date;
```



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Creating Fact Tables

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Creating the Fact Tables

Book Dimension Table (SCD Type 0)			
BookID	Book Title	Author	Price
C1	CSIRO Diet	CSIRO Team	\$45.95
H6	Harry Potter 6	Rowling	\$30.95
DV	Da Vinci Code	Dan Brown	\$27.95
...

Book Dimension Table (SCD Type 1)			
BookID	Book Title	Author	Price
C1	CSIRO Diet	CSIRO Team	\$45.95
H6	Harry Potter 6	Rowling	\$10.00
DV	Da Vinci Code	Dan Brown	\$27.95
...

BookID	Book Title	Author	Current Price	Previous Price
C1	CSIRO Diet	CSIRO Team	\$45.95	\$23.00
H6	Harry Potter 6	Rowling	\$10.00	\$30.95
DV	Da Vinci Code	Dan Brown	\$27.95	Null
...

程序代写代做 CS 编程辅导

- Book dimension table in SCD type 0, 1, 3 and 4 have the same number of records with same value.
- Table is not affected.

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BUT, when creating report, book price might not be accurate based on the Time ID

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SCD Type 4

Book Dimension Table		
BookID	Book Title	Author
C1	CSIRO Diet	CSIRO Team
H6	Harry Potter 6	Rowling
DV	Da Vinci Code	Dan Brown
...

Book Price Dimension Table				
BookID	Start Date	End Date	Price	Remarks
C1	Jan2007	July2007	\$45.95	Full Price
C1	Aug2007	Oct2007	\$36.75	20% Discount
C1	Nov2007	Jan2008	\$23.00	Half Price
C1	Feb2008	Dec9999	\$45.95	Full Price
H6	Jan2007	Mar2007	\$21.95	Launching
H6	Apr2007	Jan2008	\$30.95	Full Price
H6	Feb2008	Dec9999	\$10.00	End of Product Sale
DV	Jan2007	Dec9999	\$27.95	Full Price
...

Creating Fact Tables - SCD Type 2

程序代写代做 CS 编程辅导

- New row being added when change
 - Fact table is impacted, must be updated to contain the correct Book ID



```
create table BookSale as
select to_char(T.Transaction Date, 'MonYYYY') as TimeID,
       BK.BookID, BR.BranchID,
       sum(T.Quantity) as Number Of Books Sold
  from BookTransaction T, BK, Branch BR
 where T.BranchID = BR.BranchID
   and BK.BookID LIKE T.BOOKID || '_'
   and to_date(BK.StartDate, 'MonYYYY') <= T.Transaction Date
   and T.Transaction Date <= to_date(BK.EndDate, 'MonYYYY')
group by to_char(T.Transaction Date, 'MonYYYY'), BK.BookID, BR.BranchID;
```

Creating Fact Tables - SCD Type 2 (cont.)

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Fact Table (SCD Type 2)			
TimeID	QR	BookID	Number of Books Sold
Mar2008		C1_4	5
Mar2008		H6_3	15
Mar2008		DV_1	23
Mar2008	
Mar2008	Chadstone	C1_4	6
Mar2008	Chadstone	H6_3	3
Mar2008	Chadstone	DV_1	2
Mar2008	Chadstone
Mar2008	Camberwell	C1_4	1
Mar2008	Camberwell	H6_3	1
Mar2008	Camberwell	DV_1	2
Mar2008	Camberwell
Mar2008
...
Dec2007	City	C1_3	15
Dec2007	City	H6_2	6

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Creating Fact Tables - SCD Type 6

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- SCD Type 6 is similar to SCD Type 2, where it contains the same number of records
- The only difference is that in SCD Type 6, Book ID does not change; the original Book ID is used



```
create table BookSalesFact as
Select to_char(T.Transaction_Date, 'MonYYYY') as TimeID,
      BK.BookID, BR.BranchID, sum(T.Quantity) as Number_of_Books_Sold
from BookTransaction T, Branch BR
where T.BranchID = BR.BranchID and BK.BookID = T.BookID
      and to_date(BK.StartDate, 'MonYYYY') <= T.Transaction_Date
      and T.Transaction_Date <= to_date(BK.EndDate, 'MonYYYY')
group by to_char(T.Transaction_Date, 'MonYYYY'), BK.BookID,
      BR.BranchID;
```

Creating Fact Tables - SCD Type 6 (cont.)

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- When we join SCD Type 2 Fact Table, or when we join SCD Type 3 and the Fact Table

- Correct book price will be shown
- The reason is that both SCD Type 2 and Type 6 maintain the complete history of Book Prices; they keep the *StartDate* and *EndDate* of each Book Price

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Fact Table (SCD Type 6)			
TimeID	BranchID	BookID	Number of Books Sold
Mar2008	City	C1	5
Mar2008	City	H6	15
Mar2008	City	DV	23
Mar2008	City
Mar2008	Chadstone	C1	15
Mar2008	Chadstone	H6	3
Mar2008	Chadstone	DV	2
Mar2008	Chadstone
Mar2008	Camberwell	C1	1
Mar2008	Camberwell	H6	1
Mar2008	Camberwell	DV	2
Mar2008	Camberwell
Mar2008
...
Dec2007	City	C1	15
Dec2007	City	H6	6
Dec2007	City	DV	6
Dec2007	City
Dec2007	Chadstone	C1	10

Creating Fact Tables - Conclusion

程序代写代做 CS编程辅导

- SCD Type 2, 4 and 6 will ensure correct price is shown
 - Reason: complete price history is kept



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Differences

- SCD Type 4 uses two tables (i.e. Book Dimension and Book Price Dimension)
- SCD Type 2 and SCD Type 6 uses one table only, where the Book Price history is maintained in the Book Dimension

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Summary

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- A temporal data warehouse uses the concept of the **Bridge Table** (or a Weak Entity), where the history is maintained in a bridge table.
- Maintaining the **history of attributes** is important in order to make associative analysis more accurate when analysing the reports produced by the fact and dimensions.
- However, certain degree of caution when joining the fact table and the temporal dimension, especially when the **level of granularity** of time between the fact and the temporal dimension is not the same.
- Temporal data warehousing is also known as **Slowly Changing Dimensions(SCD)**.
 - Different types will serve different purposes of the data warehousing.

