

COMM051 Database Systems

Assignment – Sem 1, 2024/25

The **purpose** of this assignment is to give you practical experience of designing database systems and business intelligence (BI) solutions in the context of a realistic case study where you work with real data.

You will work **in groups of 6**.

The Assignment carries **100% of the mark** for the module.

1. Assignment scenario *and* Deliverables

Assignment Scenario

MumsNet was founded in 2003 and has grown over the last years to become a UK leading specialist brand for mothers-to-be and mothers of babies and pre-school children.

They offer a collection of maternity clothes, nursery equipment, accessories and toys for babies and toddlers, as well as baby clothes from new-born to 3 years old.

MumsNet markets and sells its products through its own retail stores and online via its own website MumsNet.com. The company launched its online store at the start of 2005 and has done significantly well as online sales have grown every year since then.

The management team at MumsNet would like to make improvements to its existing IT system to ensure that it meets the increasing volume of sales transactions and customer registrations.

You are part of a team of database designers which has been contracted by Mumsnet to carry out a review of the SQL Server database tables supporting the online sales application and implement improvements where you see fit (more in Deliverable D1 on page 3 of this document).

In addition, the management team at MumsNet would like to introduce a new business intelligence platform to their organisation. They would like to start analysing the data collected from the online store as they are increasingly convinced that this analysis would provide an immediate benefit to their business.

Your team has also been contracted to work on the new business intelligence platform for MumsNet (more in Deliverable D2 on page 5 of this document).

Deliverables

As a group you will create and deliver:

1. **Deliverable D1** on database design, optimisation (D1.1) and transaction processing (D1.2) as a backup SQL database file (.bak)
2. **Deliverable D2** on a 'proof of concept' business intelligence platform, as a SSAS project (.sln)
3. **Deliverable D4** is a demo in a 5-minute long video where you briefly outline your solutions for both Deliverables D1, D2 and show that they work.

As an individual, you will deliver:

4. **Deliverable D3** which is a Final Report on your experience and contribution to the group work on all aspects of the coursework, as a PDF file

Further information on each of the 4 deliverables, including how each will be submitted, is provided below.

Deliverable D1

The following three tables have been given to you by the Mumsnet Systems Administrator from the production environment and contain historic order, product and customer information from January 2005 until December 2009.

CustomerCity (dbo)		
Column	Type	Nullable
Id	bigint	<input type="checkbox"/>
Gender	nvarchar (255)	<input checked="" type="checkbox"/>
FirstName	nvarchar (255)	<input checked="" type="checkbox"/>
LastName	nvarchar (255)	<input checked="" type="checkbox"/>
DateRegistered	datetime (24, 3)	<input checked="" type="checkbox"/>
City	nvarchar (255)	<input checked="" type="checkbox"/>
County	nvarchar (255)	<input checked="" type="checkbox"/>
Region	nvarchar (255)	<input checked="" type="checkbox"/>
Country	nvarchar (255)	<input checked="" type="checkbox"/>
Indexes (0)		
Keys (0)		
Check Constraints (0)		

Product (dbo)		
Column	Type	Nullable
ProductGroup	nvarchar (128)	<input type="checkbox"/>
ProductCode	nvarchar (50)	<input type="checkbox"/>
VariantCode	nvarchar (50)	<input type="checkbox"/>
Name	nvarchar (256)	<input type="checkbox"/>
Cup	nvarchar (256)	<input checked="" type="checkbox"/>
Size	nvarchar (256)	<input checked="" type="checkbox"/>
LegLength	nvarchar (256)	<input checked="" type="checkbox"/>
Colour	nvarchar (256)	<input checked="" type="checkbox"/>
Price	money	<input checked="" type="checkbox"/>
Features	nvarchar (3600)	<input checked="" type="checkbox"/>
Description	nvarchar (3600)	<input checked="" type="checkbox"/>
Indexes (0)		
Keys (0)		
Check Constraints (0)		

OrderItem (dbo)		
Column	Type	Nullable
OrderNumber	nvarchar (50)	<input type="checkbox"/>
OrderCreateDate	datetime (24, 3)	<input type="checkbox"/>
OrderItemNumber	nvarchar (32)	<input type="checkbox"/>
OrderStatusCode	int	<input type="checkbox"/>
CustomerCityId	bigint	<input type="checkbox"/>
BillingCurrency	nvarchar (8)	<input type="checkbox"/>
ProductGroup	nvarchar (128)	<input type="checkbox"/>
ProductCode	nvarchar (50)	<input type="checkbox"/>
VariantCode	nvarchar (50)	<input type="checkbox"/>
Quantity	int	<input type="checkbox"/>
UnitPrice	money	<input type="checkbox"/>
LineItemTotal	money	<input type="checkbox"/>
Indexes (0)		
Keys (0)		
Check Constraints (0)		

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D1.1 – database design, optimisation:

Your team has reviewed the MumsNet.com database tables and has made the observation that the OrderItem, Product and Customer tables are not normalised to the third normal form (3NF).

- All three tables need to be normalised to 3NF and existing data migrated to the new data structure. Also ensure primary and foreign keys are defined in the resulting (normalised) database schema to safeguard the data integrity of the database.
- There is a business requirement that an Order Group entity/relation is introduced in the database schema with the following attributes and relationships:
 - OrderNumber: A string attribute that contains the order number. You observe that this is an existing attribute in the OrderItem table in the database schema. An order number has the format OR\DDMMYYYY\NN, where NN is a sequential number from 01 to 99, for example OR\01012006\04.
 - OrderStatusCode: A string attribute that contains the status code of the order. You observe that this is an existing attribute in the OrderItem table in the database schema. The OrderStatusCode attribute contains the following order status codes:
 - 0: This is a new order
 - 1: This an abandoned order
 - 2: This is an unfulfilled order due to out of stock item(s)
 - 3: This is an order that have been cancelled by the customer
 - 4: This is a fulfilled order; the goods have been shipped to the customer
 - OrderCreateDate: The order creation date. You observe that this is an existing attribute in the database schema (an attribute of the OrderItem table, in particular).
 - BillingCurrency: The billing currency of the order. You observe that this is an existing attribute in the database schema (an attribute of the OrderItem table, in particular).
 - TotalLineItems: The total number of items ordered. You observe that this is a new attribute in the database schema.
 - SavedTotal: The total order value. You observe that this is a new attribute in the database schema.
 - The Order Group entity may contain zero or more order items.

<20 marks>

D1.2 – transaction processing:

Your team has also been asked to develop new stored procedures to deliver order processing functionality for the new Order Group Entity:

- a) Develop the stored procedure **prCreateOrderGroup**; the execution of this program will create a new order based on the parameter values supplied below:

```
-OrderNumber: nvarchar(32)  
-OrderCreateDate: datetime  
-CustomerCityId: int
```

- b) Develop the stored procedure **prCreateOrderItem**; the execution of this program will create a new order line based on the parameter values supplied below:

```
-OrderNumber nvarchar(32)  
-OrderItemNumber nvarchar(32)  
-ProductGroup nvarchar(128)  
-ProductCode nvarchar(255)  
-VariantCode nvarchar(255)  
-Quantity int  
-UnitPrice money
```

The new stored procedures must contain error handling and transactional support to ensure that the data consistency is maintained during successful and unsuccessful program execution. Implement indexes to improve order processing performance.

<15 marks>

Deliverable D2

Your team has been asked to deliver a 'proof of concept' business intelligence platform using Microsoft SQL Server 2018 Analysis Services (SSAS/SSDT) to satisfy the following data requirements:

- Number of cancelled orders
- Percentage of orders cancelled by the customer
- Sales value of cancelled orders
- Number of unfulfilled basket orders due to out of stock item(s)
- Percentage of all unfulfilled basket orders
- Percentage of abandoned basket orders
- Percentage of fulfilled orders
- All percentage calculations are against total orders placed
- All order calculations should be broken down, by product, by customer, by day
- Sales and quantity sold by product, by customer, by day
- Ordered stock quantity by product, by ordered day
- Customer rolls into city, which rolls into region, which rolls into country
- Product rolls into product group
- Day rolls into month, which rolls into quarter, which rolls into year
- All product calculations must be broken down to product variant level

You will need to create an appropriate Data Source View (DSV) and design corresponding Cube measures and dimensions with the above characteristics.

Your BI solution should be delivered as an SSDT project (.sln), in the same way as the projects you will build for Lab 5 and Lab 6 in the course.

<25 marks>

Deliverable D3

Each member of the group will need to produce a concise final report that should read as an executive summary on the process of collaboration, your contribution and lessons learned.

A template of the report, with recommended sections, is provided in a separate document titled “COMM051_Final_Report_Template.doc” found on SurreyLearn. Please make sure you follow this template in producing your report.

The report **should not exceed 1,000 words in total**.

It should be submitted *individually* as a PDF document via SurreyLearn. So each member of the group submits their own Deliverable D3.

<20 marks>

Deliverable D4

Your group will produce a short video (up to 5minutes long) where you will present your approach to database design, including optimisation and transactions for Deliverable D1, as well as the BI solution developed for Deliverable D2.

This will be submitted via SurreyLearn.

<20 marks>

2. Assessment Criteria

2.1 Group marks:

The technical deliverables D1, D2 and D4 of this project concern the creation and delivery of “the product” or solution, which is shared and therefore the whole group gets the same mark for these parts of the assignment.

More specifically, Deliverables D1 and D2 will be assessed based on the following criteria:

Concept	Assessment
Normalisation (D1.1)	Appropriate creation of normalised table structures
Relational Model Constraints (D1.1)	Appropriate use of primary and foreign keys
SQL Optimisation (D1.1)	Appropriate use of indexes based on SQL query usage to improve database performance
Error Handling (D1.2)	Appropriate use of TRY/CATCH statements
Concurrency Control (D1.2)	Appropriate use of BEGIN TRAN / COMMIT / ROLLBACK statements
Data Source View design (D2)	Appropriate use of Data Source Views
Cube Measures and Dimensions design (D2)	Appropriate use of measures and dimensions to produce required calculations

Deliverable D4 will be assessed based on the following criteria:

Deliverable D4 – Demo / video

70-100	A compelling attempt at demonstrating all aspects of the solutions and how these meet all the business requirements. Excellent demo, giving a convincing case, the solution of which can realistically be used. All topics and contributions were crystal clear.
60-70	A compelling attempt at demonstrating most aspects of the solutions and how these meet the corresponding business requirements. Well-structured demo, with a crisp message.
50-60	A reasonable attempt at demonstrating most aspects of the solutions and how these meet the corresponding business requirements. The demo could have been organised better; the message could have been made clearer.
40-50	A reasonable attempt at demonstrating some aspects of the solutions and how these meet corresponding business requirements. The demo was not well organised, the message was not convincing or clear.
0-40	No evidence of any substantial effort at demonstrating aspects of the solutions and how the corresponding business requirements were met. The demo was disorganised, and the message was unclear.

IMPORTANT NOTE:

If based on evidence it is clear that an individual in a group has not contributed at all, then they will be considered as “not submitting” the coursework and will get a 0 mark.

2.2 Individual marks:

The Final report deliverable (D3) is mostly concerned with “the process” of delivering the product or solution, including what each group member contributed but also what each member learned from working with the group. Therefore, this deliverable is marked individually.

More specifically, Deliverables D3 and D4 will be assessed based on the following criteria:

Deliverable D3 – Final Report

70-100	Excellent structure and a concise report using language and detail appropriate for the intended audience. Well-articulated arguments and critical appraisal of the learning experience. Excellent evidence of the process of collaboration.
60-70	Well-structured and concise report aimed at the intended audience. Crisp message but some arguments and aspects of the critical appraisal could have been made clearer. Strong evidence of the process of collaboration.
50-60	The report is of acceptable quality for the intended audience. Arguments and critical appraisal could have been organised better, with more clarity. Some evidence of the process of collaboration.
40-50	The report is not of acceptable quality for the intended audience. Arguments and critical appraisal are not convincing or clear. Little to no evidence of the process of collaboration.
0-40	No evidence of any substantial effort. Arguments and critical appraisal are not convincing and the contributions not clear. No evidence of the process of collaboration.

3. Submission

All deliverables for the coursework – Deliverables D1, D2, D3, D4 should be submitted electronically **via SurreyLearn** before the deadline of **Tuesday 3 December (Week 11)** by **4pm**.

3.1 Group Deliverables – D1, D2 and D4

Deliverables D1, D2, and D4 should be submitted electronically **via SurreyLearn** as a zipped file by one member of the group.

The zipped file should contain

- the developed Business Intelligence solution, i.e., all SSAS project files (including a .sln file) and
- the modified coursework database as a backup file (.bak)
- the video file (.mp4)

One zipped file should be submitted **by each group**.

IMPORTANT:

The **name** of the file **should start with the group number**.

For example, the submission of group 4 should be a zipped file named ‘Group4_coursework.zip’

3.2 Individual Deliverable – D3

Deliverable D3 should be submitted electronically via SurreyLearn as a PDF file, individually, by each member of the group.

The **name** of the file **should start with your 'name-surname'**.

For example, the submission of Sotiris Moschoyiannis should be a PDF file named as 'Sotiris-Moschoyiannis-D3.pdf'

4. Dates and guidelines

Key dates

Assignment released: Week 5

Groups formed: by Week 7

Deadline for submission:

Deliverables D1, D2, D3, D4: Week 11 – **Tuesday 3 December 2024** before 4pm, via SurreyLearn

Extensions, Late Submissions and Academic Integrity:

Coursework will be routinely checked for academic misconduct. Please refer to your Student Handbook and the advice given in SurreyLearn on *cheating*, *plagiarism* and *collusion* and make sure that you understand the regulations. If you are in any doubt, please seek advice from your Module Leader or Personal Tutor.

Students are reminded of the University policy on late submission of coursework as outlined in the Student Handbook and on the policy for extenuating circumstances (ECs).

Form a Group

You will work in groups in this assignment. Each group must consist of 6 members. Any smaller or larger groups are only allowed in special circumstances and this must be agreed on and confirmed by the Module Leader.

To form your group, please

- identify yourself with 5 other people
- enrol yourselves in a group: on the module section on SurreyLearn, look for Groups on the menu, choose an empty group and add yourselves to that group.

If you are not part of any group, you need to let me (Sotiris) know and you will be assigned to a group.

NOTE: Deadline for submission is **Tuesday 3 December (Week11)** by **4pm**.