



UNIVERSITETET I BERGEN

KANDIDAT

162

PRØVE

INF115 0 Databaser og modellering

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General exam information

Oppgave	Tittel	Oppgavetype
i	General info about digital campus exam - INF115, spring 22	Informasjon eller ressurser

Instructions for Part 1

Oppgave	Tittel	Oppgavetype
i	Instructions for Multiple Choice Questions	Informasjon eller ressurser

Part 1 - Multiple Choice Questions - 20 Points

Oppgave	Tittel	Oppgavetype
1	Subqueries	Flervalg (flere svar)
2	Foreign keys	Flervalg (flere svar)
3	Tables are joined	Flervalg (flere svar)
4	Aggregate Functions	Flervalg (flere svar)
5	Files	Flervalg (flere svar)
6	Two columns	Flervalg (flere svar)
7	Use views	Flervalg (flere svar)
8	Blocks	Flervalg (flere svar)
9	Indices	Flervalg (flere svar)
10	Join query	Flervalg (flere svar)

Instructions for Part 2

Oppgave	Tittel	Oppgavetype
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i Instructions Part 2Informasjon eller
ressurser**Part 2 - Concepts - 15 Points**

Oppgave	Tittel	Oppgavetype
11	ER model	Nedtrekk
12	Properties of Transactions	Nedtrekk

Instructions for Part 3

Oppgave	Tittel	Oppgavetype
i	Instructions for Part 3	Informasjon eller ressurser

Part 3 - Exercise on Diagrams and Queries - 15 Points

Oppgave	Tittel	Oppgavetype
13	Diagram	Plasser i bilde
14	Query 1	Plasser i tekst
15	Query 2	Plasser i tekst
16	Algebra 1	Plasser i tekst
17	Algebra 2	Plasser i tekst

Instructions for Part 4

Oppgave	Tittel	Oppgavetype
i	Instructions for Part 4	Informasjon eller ressurser

Part 4 - Normalization of a Table - 20 Points

Oppgave	Tittel	Oppgavetype
18	Redundancy	Langsvar
19	Functional dependencies	Langsvar
20	Candidate Key	Flervalg (flere svar)
21	Types of dependencies	Flervalg (flere svar)
22	Normal Form	Flervalg (flere svar)
23	Normalise the Table	Langsvar

Mandatory Assignments

Oppgave	Tittel	Oppgavetype
24	Mandatory Assignments	Tekstfelt

1 Subqueries

Subqueries can be used in :

Select one or more alternatives:

☒ FROM clauses

☒ SELECT clauses

☐ WHATIF clauses

☐ UPDATE, INSERT and DELETE clauses

Maks poeng: 2

2 Foreign keys

Which statements are correct?

Select one or more alternatives:

- ☐ Foreign keys cannot contain Null values.
- ☒ Foreign keys can be composed of multiple columns.
- ☒ A foreign key is an attribute A that is union compatible with a primary key B.
- ☒ The values in a foreign key A are a subset of the values in a primary key B.

Maks poeng: 2

3 Tables are joined

Tables are ____ joined on *foreign keys*.

Select one or more alternatives:

- ☒ often
- ☐ never
- ☐ rarely
- ☐ only

Maks poeng: 2

4 Aggregate Functions

Select all **aggregate functions**:

Select one or more alternatives:

☒ AVG

☒ COUNT

☐ LOWER

☒ MIN

☐ UPPER

Maks poeng: 2

5 Files

Which statements are correct ?

Select one or more alternatives:

☒ Every digital storage medium is a numbered sequence of bytes.

☐ In general, the memory (RAM) is large enough to contain the whole database.

☐ The DBMS wants to maximise the number of I/O operations.

☒ A file consists of records which are made of fields.

Maks poeng: 2

6 Two columns

Which statements are true?

Two columns compared to each other in a join ...

Select one or more alternatives:

☐ can have different datatypes.

☒ can be primary keys.

☐ must have the same name.

☒ can be foreign keys.

Maks poeng: 2

7 Use views

Views can be used to:

Select one or more alternatives:

☒ Store queries in the database.

☒ Adapt the database to different users.

☐ Guarantee independence of representation of data.

☒ Break up complex queries.

Maks poeng: 2

8 Blocks

Select the correct statements.

Select one or more alternatives:

- ☐ The filling ratio of blocks cannot be controlled.
- ☒ A block is the smallest unit to transfer data between the external storage and the RAM.
- ☐ The DBMS keeps track of which data is stored in which blocks.
- ☒ A file is composed of blocks.

Maks poeng: 2

9 Indices

Select the correct statements about indices.

Select one or more alternatives:

- ☒ Indices must be kept up-to-date when updating tables.
- ☐ Indices require no additional storage.
- ☐ Indices are unsorted data structures.
- ☒ Indices optimise and speed up searching.

Maks poeng: 2

10 Join query

Which statements are true about the following query ?

```
SELECT *  
FROM T1, T2  
T1 INNER JOIN T2 ON T1.col1 = T2.col2
```

Select one or more alternatives:

☐ col2 is always a foreign key.

☒ This is the standard form of an inner join.

☐ The order of tables in the query matters.

☒ This inner join can also be written using a WHERE section.

Maks poeng: 2

11 ER model

Select the correct alternative for each gap:

The structure of a database can be represented (~~experimentally~~, ~~graphically~~,

~~syntactically~~) using (~~Effectively Random~~, ~~Example Row~~, ~~Entity Relationship~~) diagrams. These diagrams can include more or less details, depending on whether

the level of the representation is abstract, logical or conceptual. An (element, entity, essence) is a physical or an abstract object about which we want to store information.

Entities have interesting properties called (~~attributes~~, ~~alternatives~~, ~~arguments~~).

In addition they must have (~~identifiers~~, ~~columns~~, ~~rows~~) which composed of one

or several (~~attributes~~, ~~arguments~~, ~~alternatives~~) that

(~~ambiguously choose~~, ~~physically repeat~~, ~~uniquely determine~~) an occurrence. A

(~~representation~~, ~~graph~~, ~~relationship~~) between (~~entities~~, ~~arguments~~, ~~relationships~~) represents how they are connected to each other. In Entity Relationship diagrams

relationships are represented by (~~multiple repeating~~, ~~relative ordering of~~, ~~lines~~

~~connecting~~) entities. The (~~abstraction~~, ~~ordering~~, ~~cardinality~~) of a relationship

expresses how many (~~occurrences~~, ~~columns~~, ~~attributes~~) of an entity A can or

must be connected to an (~~occurrence~~, ~~attribute~~, ~~column~~) of an entity B.

Maks poeng: 11

12 Properties of Transactions

Select the correct definition for each term:

Atomicity: (All or none of the sub-operations of a transaction must be completed., A transaction moves the database from one valid state to another valid state., The effect of completed transactions is stored in the database and shall not be lost due to errors., The effect of transactions in progress should not be observable by other transactions.)

Consistency: (The effect of completed transactions is stored in the database and shall not be lost due to errors., The effect of transactions in progress should not be observable by other transactions., A transaction moves the database from one valid state to another valid state., All or none of the sub-operations of a transaction must be completed.)

Isolation:

(A transaction moves the database from one valid state to another valid state., All or none of the sub-operations of a transaction must be completed., The effect of completed transactions is stored in the database and shall not be lost due to errors., The effect of transactions in progress should not be observable by other transactions.)

Durability:

(All or none of the sub-operations of a transaction must be completed., A transaction moves the database from one valid state to another valid state., The effect of transactions in progress should not be observable by other transactions., The effect of completed transactions is stored in the database and shall not be lost due to errors.)

Maks poeng: 4

Data Model

In this exercise, you work on a database for a book club.

The database contains several entities:

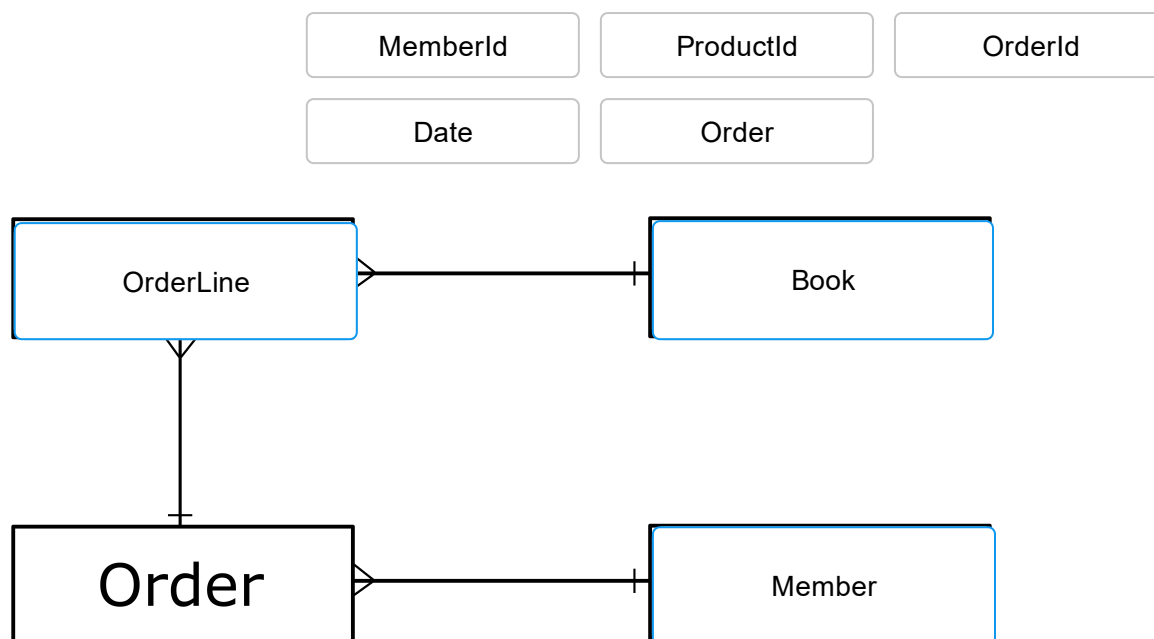
- Book (__ProductId__, Author, Title, Category, Price, NumberInStock)
- Order(__OrderId__, MemberId*, Date)
- Orderline(__OrderId__ *, __ProductId__ *, Antall)
- Member(__MemberId__, FirstName, LastName, Address)

Primary keys are underlined and foreign keys are followed by a star.

13 Diagram

Correctly position the names of the entities in the gaps in this conceptual diagram.

 [Hjelp](#)



Maks poeng: 3

14 Query 1

Place the tokens in the gaps in the query below so that it returns the books which cost more than 300 kr and the result is ordered alphabetically by author.

 [Hjelp](#)

Member	MemberId	Title
LastName	Date	Order

SELECT *

FROM
WHERE >= 300
ORDER BY

Maks poeng: 3

15 Query 2

Place the tokens in the gaps in the query below so that it returns the number of orders placed by each member in 2021.

 [Hjelp](#)

AVG	DATE	ProductId	MONTH	OrderLine
Book				

SELECT (*)
FROM
WHERE (Date) = 2021
GROUP BY

Maks poeng: 4

16 Algebra 1

Translate the following query into relational algebra:

```
SELECT Order.MemberId, OrderLine.ProductId
FROM Order INNER JOIN OrderLine ON Order.OrderId = OrderLine.OrderId
```

Complete the expression below:

 Hjelp

=	σ		
×	ProductId	MemberId	
Π	MemberId, ProductId (Order		□
OrderLine.OrderId	OrderLine)		Order.OrderId =

Maks poeng: 3

17 Algebra 2

Translate the following query into relational algebra:

```
SELECT *
FROM Book
WHERE NumberInStock > 100
```

Complete the expression below:

 Hjelp

Π	Order		
Member	×		
σ	NumberInStock > 100 (Book
)			

Maks poeng: 2

Normalization Exercise

The table *Investment* contains data about shares of companies that have been bought by the clients of a bank.

Investment(*StockId*, *CompanyName*, *ClientId*, *LastName*, *StockMarketId*, *Municipality*, *Date*, *Time*, *TotalPrice*, *UnitPrice*, *UnitsBought*)

The example row below tells us that shares of the company Twitter Inc with StockId TWTR:US have been bought by a client with ClientId 112233445566 and LastName Musk. The buying transaction was performed on the market with StockMarketId 27 on 17.05.2022 at 21:00 (local time). This market is located in New York City municipality. The client bought 764 180 688 units of the stock at a unit price of 54.20 USD and a total amount of 41 418 593 289.60 USD.

('TWTR:US', 'Twitter Inc', 112233445566, 'Musk', 27, 'New York City', 17.05.2022, 21:00, 41418593289.60, 54.2, 764180688)

Answer all six of the questions below.

Note: You must indicate primary keys by underlining them (or use __PKName__) and foreign keys with a trailing star (e.g. FKName*).

You can give names to tables and use the following notation $A \rightarrow B$.

18 Redundancy

The table *Investment* contains redundancy. **Give one example of this (maximum 12 words).**

Fill in your answer here

StockID -> StockMarketID -> Municipality
StockMarketID is redundant

Ord: 8

Maks poeng: 2

19 Functional dependencies

Now determine and list all functional dependencies in the table.

Note: Please write **one** functional dependency per line.

Maximum 60 words.

Fill in your answer here

ClientId -> LastName

StockID -> CompanyName, StockmarketId, UnitPrice

In the dependency above i assume that a stock can only be registered at one stock market.

StockMarketID -> Municipality

UnitPrice + UnitsBought -> TotalPrice

TotalPrice + UnitsBought -> UnitPrice

UnitPrice + TotalPrice -> UnitsBought

Ord: 40

Maks poeng: 6

20 Candidate Key

Which columns are part of the candidate key for this table ?

Note: You have to select all correct columns, otherwise zero points are given.

Select one or more alternatives:

☐ UnitPrice

☒ Time

☐ CompanyName

☐ Municipality

☐ StockMarketId

☐ TotalPrice

☒ StockId

☒ Date

☒ ClientId

☐ LastName

☒ UnitsBought

Maks poeng: 2

21 Types of dependencies

Which of these types of dependencies occur in the table *Investment* ?

Note: Select all that apply.

Select one or more alternatives:

☐ A determinant that is not a super-key

☒ Transitive dependencies

☐ Partial dependencies

Maks poeng: 3

22 Normal Form

Which are the normal forms verified by the table *Investment* ?

Note: You have to select all normal forms up to and including the highest normal form that is verified, otherwise zero points are given.

Select one or more alternatives:

☒ First Normal Form

☐ Third Normal Form

☐ None of these normal forms

☐ Boyce-Codd Normal Form

☒ Second Normal Form

Maks poeng: 2

23 Normalise the Table

Perform the normalization to the Boyce-Codd normal form (BCNF) and describe the result in text form. Remember to indicate the primary and foreign keys in the resulting tables.

Maximum 60 words.

Fill in your answer here

I want to separate this table into five tables.

Stockinfo(StockID,CompanyName,StockmarketID*,UnitPrice)

ClientInfo(ClientID,LastName)

StockMarket(StockMarketID,Municipality)

Order(StockID*,ClientID*,UnitsBought,TotalPrice,TimeStampID*)

TimeInfo(TimeStampID,Date,Time)

One assumption i have done is that a stock can only be registered in one stock market at a time.

Ord: 34

Maks poeng: 5

24 Mandatory Assignments

Here, you can enter the points (convert to points out of 30) that you earned on your mandatory assignments and leave a comment about the exam.

This field is optional.

Fill in your answer here

Maks poeng: 30