



UNIVERSITETET I BERGEN

KANDIDAT

174

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	Table Icebears	Flervalg (flere svar)
3	Indices	Flervalg (flere svar)
4	Aggregate Functions	Flervalg (flere svar)
5	Sparse indices	Flervalg (flere svar)
6	Subqueries	Flervalg (flere svar)
7	Instances and Types	Flervalg (flere svar)
8	Views are	Flervalg (flere svar)
9	Databases in the Cloud	Flervalg (flere svar)
10	Foreign keys	Flervalg (flere svar)

Instructions for Part 2

Oppgave	Tittel	Oppgavetype
i	Instructions Part 2	Informasjon eller ressurser

Part 2 - Concepts - 15 Points

Oppgave	Tittel	Oppgavetype
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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:

☐ WHATIF clauses

☒ UPDATE, INSERT and DELETE clauses

☒ FROM clauses

☒ SELECT clauses

Maks poeng: 2

2 Table Icebears

How do we delete all rows from the table Icebears ?

Select one or more alternatives:

☒ DELETE FROM Icebears;

☐ Robert'); DROP TABLE Icebears; --

☐ DROP TABLE Icebears;

☐ ELIMINATE TABLE Icebears;

Maks poeng: 2

3 Indices

Select the correct statements about indices.

Select one or more alternatives:

☒ Indices must be kept up-to-date when updating tables.

☒ Indices optimise and speed up searching.

☐ Indices are unsorted data structures.

☐ Indices require no additional storage.

Maks poeng: 2

4 Aggregate Functions

Select all **aggregate functions**:

Select one or more alternatives:

☒ AVG

☐ LOWER

☒ COUNT

☐ UPPER

☒ MIN

Maks poeng: 2

5 Sparse indices

Select the correct statements below.

Select one or more alternatives:

☐ Dense indices contain one entry for every entry in the file.

☒ Sparse indices contain one entry per block in a file.

☒ Dense indices are smaller than sparse indices.

☒ Multiple sparse indices per file are possible.

Maks poeng: 2

6 Subqueries

The subquery is ...

Select one or more alternatives:

☒ can be nested inside another subquery.

☒ run first and the result is substituted into the main query.

☐ cannot contain operators such as IN, ALL etc.

☐ run after the main query.

Maks poeng: 2

7 Instances and Types

Which statements about instances and types are correct ?

Select one or more alternatives:

☐ The entity type represents the whole table.

☒ The entity type represents one row in a table.

☒ An entity instance corresponds to a row in a table.

☐ An entity instance corresponds to a column in a table.

Maks poeng: 2

8 Views are

Which of these statements about views are correct ?

Select one or more alternatives:

- ☐ Views are stored as tables in the database.
- ☒ Views are usually sorted.
- ☒ Only the view definition (query) is stored in a system table.
- ☒ The query defining a view can use multiple tables.

Maks poeng: 2

9 Databases in the Cloud

Select the correct statements.

Select one or more alternatives:

- ☒ Security and encryption are of highest importance when working with databases on the web and in cloud services.
- ☒ A cloud database solution can be based on IaaS, PaaS or SaaS.
- ☐ Databases on cloud services are easy to manage and to scale up.
- ☐ A database in a cloud service will never be down or in an inconsistent state.

Maks poeng: 2

10 Foreign keys

Which statements are correct?

Select one or more alternatives:

☒ Foreign keys can be composed of multiple columns.

☐ Foreign keys cannot contain Null values.

☒ 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

11 ER model

Select the correct alternative for each gap:

The structure of a database can be represented graphically (graphically, experimentally, syntactically) using Entity Relationship (Effectively Random, Entity Relationship, Example Row) diagrams. These diagrams can include more or less details, depending on whether the level of the representation is abstract, logical or conceptual. An entity (element, essence, entity) is a physical or an abstract object about which we want to store information. Entities have interesting properties called attributes (arguments, alternatives, attributes). In addition they must have identifiers (columns, rows, identifiers) which composed of one or several attributes (alternatives, arguments, attributes) that uniquely determine (physically, repeat, uniquely determine, ambiguously choose) an occurrence. A relationship (graph, representation, relationship) between entities (entities, arguments, relationships) represents how they are connected to each other. In Entity Relationship diagrams relationships are represented by lines connecting (lines connecting, relative ordering of, multiple repeating) entities. The cardinality (ordering, cardinality, abstraction) of a relationship expresses how many occurrences (occurrences, columns, attributes) of an entity A can or must be connected to an occurrence (occurrence, attribute, column) of an entity B.

Maks poeng: 11

12 Properties of Transactions

Select the correct definition for each term:

Atomicity: (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.)

Consistency: (The effect of completed transactions is stored in the database and shall not be lost due to errors., 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.)

Isolation:

(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., All or none of the sub-operations of a transaction must be completed.)

Durability:

(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., A transaction moves the database from one valid state to another valid state.)

Maks poeng: 4

Data Model

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

The database contains several entities:

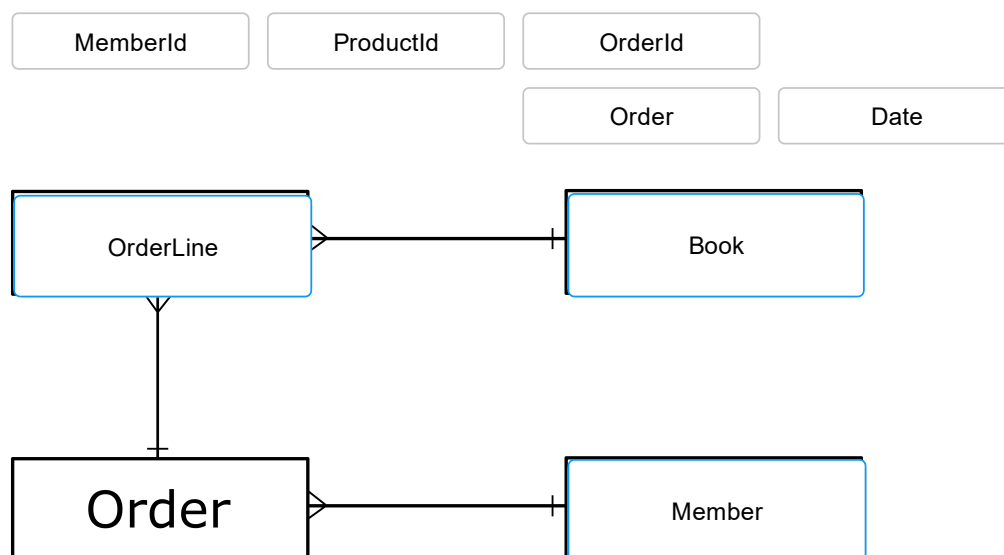
- Book (ProductId, Author, Title, Category, Price, NumberInStock)
- Order(OrderId, MemberId*, Date)
- Orderline(OrderId *, ProductId *, Antall)
- Member(MemberId, FirstName, LastName, Address)

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](#)

Date	Title	LastName	Order
MemberId	Member		

SELECT *

FROM

Book

WHERE

Price

>= 300

ORDER BY

Author

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](#)

MONTH	AVG	ProductId
YEAR	Book	OrderLine

SELECT

COUNT

(*)

FROM

Order

WHERE

DATE

(Date) = 2021

GROUP BY

MemberId

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](#)

\times	ProductId	MemberId
=	σ	
Π	MemberId, ProductId (Order	\square Order.OrderId =
OrderLine.OrderId	OrderLine)	

Maks poeng: 3

17 Algebra 2

Translate the following query into relational algebra:

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

Complete the expression below:

 [Hjelp](#)

σ	\times	Member
	Order	
Π	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

UnitPrice

Ord: 1

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

```
StockId -> CompanyName
ClientId -> LastName
StockMarkedId -> Municipality
UnitPrice, UnitsBought -> TotalPrice
TotalPrice, UnitsBought -> UnitPrice
TotalPrice, UnitPrice -> UnitsBought
```

Ord: 21

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:

- ☐ Time
- ☐ CompanyName
- ☐ TotalPrice
- ☐ UnitsBought
- ☐ LastName
- ☐ Date

☒ StockMarketId

☐ UnitPrice

☐ Municipality

☒ StockId

☒ ClientId

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:

☐ Transitive dependencies

☒ A determinant that is not a super-key

☐ 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:

☐ Boyce-Codd Normal Form

☒ Second Normal Form

☒ First Normal Form

☐ None of these normal forms

☒ Third 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

Since I have pointed out 3 candidate keys, I will split Investment into 4 tables.
I have also made a unique attribute SaleID, which tracks all unique sales. You could, however, put all 3 foreign-keys in Sale together as one, but since a client can buy mulitble_stocks_from_the_same_company_many_times_,_I_think_it_would_be_better_with_one_unique_ID.

Client(ClientID, LastName)

Stock(StockID, CompanyName)

Stockmarked(StockMarkedID, Municipality)

Sale(SaleID, ClientID*, StockMarkedID*, StockID*, Date, Time, TotalPrice, UnitPrice, UnitsBought)

Ord: 60

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

100+92+100 = 292
Happy summer-holydays!!!

Task 23:

**In this task, I will NOT assume that a specific stock is related to any specific stockmarked. I will also NOT assume that this task will not require a seller (as of someone needs to sell the stocks on order for them to be bought). Note: I have also made a new attribute called SaleID, which uniquely stores information about every sale

Maks poeng: 30