UNIVERSITETET I BERGEN

KANDIDAT

166

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 2023	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	Table People	Flervalg (flere svar)
2	Algebra	Flervalg (flere svar)
3	Indices	Flervalg (flere svar)
4	Subqueries	Flervalg (flere svar)
5	Files	Flervalg (flere svar)
6	Sparse indices	Flervalg (flere svar)
7	Views are	Flervalg (flere svar)
8	Subtypes	Flervalg (flere svar)
9	Blocks	Flervalg (flere svar)
10	Join query	Flervalg (flere svar)

Instructions for Part 2

Oppgave	Tittel	Oppgavetype

| | Instructions Part 2 | Informasjon eller ressurser |

Part 2 - Concepts - 20 Points

Oppgave	Tittel	Oppgavetype
11	Databases	Nedtrekk
12	ER models	Nedtrekk
13	Properties of Transactions	Nedtrekk
14	Database Life Cyle	Plasser i tekst

Instructions for Part 3

Oppgave	Tittel	Oppgavetype
i	Instructions for Part 3	Informasjon eller ressurser

Part 3 - Exercise on Diagrams and Queries - 10 Points

Oppgave	Tittel	Oppgavetype
15	Diagram	Plasser i bilde
16	Query 1	Plasser i tekst
17	Query 2	Plasser i tekst
18	Algebra 1	Plasser i tekst
19	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
20	Redundancy	Langsvar
21	Functional dependencies	Langsvar
22	Candidate Key	Flervalg (flere svar)
23	Types of dependencies	Flervalg (flere svar)
24	Normal Form	Flervalg (flere svar)
25	Normalise the Table	Langsvar

Mandatory Assignments

Oppgave	Tittel	Oppgavetype
26	Mandatory Assignments	Tekstfelt

1 Table People

We want to create a table *People*.

How to set the primary key ?
Select one or more alternatives:

- [ ] PersNr CHAR(11) UNIQUE NOT NULL

- [ ] DROP CONSTRAINT PeoplePK;

- [ ] PersNr CHAR(15)

- [x] CONSTRAINT PeoplePK PRIMARY KEY (PersNr)

Maks poeng: 2

2 Algebra

Which statements are correct?
Select one or more alternatives:

- [ ] SQL is not relationally complete.

- [x] A query language is relationally complete if it is equal in expressive power to relational algebra.

- [ ] Every query can be written in relational algebra.

- [x] SQL is based on relational algebra.

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 are unsorted data structures.

- ☐ Indices require no additional storage.

- ☑ Indices optimise and speed up searching.

Maks poeng: 2

4 Subqueries

The subquery ...
Select one or more alternatives:

- ☐ is run after the main query.

- ☑ is run first and the result is substituted into the main query.

- ☐ cannot contain operators such as IN, ALL etc.

- ☑ can be nested inside another subquery.

Maks poeng: 2

5 Files

Which statements are correct ?
Select one or more alternatives:

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

- [ ] The DBMS wants to maximise the number of I/O operations.

- [x] A file consists of records which are made of fields.

- [x] Every digital storage medium is a numbered sequence of bytes.

Maks poeng: 2

6 Sparse indices

Select the correct statements below.

Select one or more alternatives:

- [ ] Dense indices are smaller than sparse indices.

- [x] Sparse indices contain one entry per block in a file.

- [x] Dense indices contain one entry for every entry in the file.

- [ ] Multiple sparse indices per file are possible.

Maks poeng: 2

7 Views are

Which of these statements about views are correct ?

Select one or more alternatives:

- [ ] Views are usually sorted.

- [x] Only the view definition (query) is stored in a system table.

- [x] The query defining a view can use multiple tables.

- [ ] Views are stored as tables in the database.

Maks poeng: 2

8 Subtypes

Which statements about subtypes are true ?

Select one or more alternatives:

- [x] A subtype must be an aggregation of another entity.

- [x] Subtypes correspond to subsets of the sets of instances.

- [x] A subtype is a specialisation of another entity.

- [ ] Subtypes can have additional attributes.

Maks poeng: 2

9 Blocks

Select the correct statements.

Select one or more alternatives:

- ☑ A file is composed of blocks.

- ☑ The DBMS keeps track of which data is stored in which blocks.

- ☐ The filling ratio of blocks cannot be controlled.

- ☑ A block is the smallest unit to transfer data between the external storage and the RAM.

Maks poeng: 2

10 Join query

Which statements are true about the following query ?

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

Select one or more alternatives:

- ☐ The order of tables in the query matters.

- ☐ col2 is always a foreign key.

- ☑ This is the standard form of an inner join.

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

Maks poeng: 2

11 Databases

Select the correct alternative for each gap:

A [relational] (random, relational, relatedness)database is a collection of tables. Such a

database can be queried using the [structured query] (standard query, structured query, structured quaint)language which has been developed since 1974. SQL is interpreted by the

[database management system] (database management system, data systems, unix managers). It allows us to define tables and the structure of the database, as well as

manipulating [table contents] (physical objects, table contents, statistics)and managing user

[rights] (obligations, rights, wishes).

Maks poeng: 5

12 ER models

Select the correct alternative for each gap:

The ⟨Entity Relationship⟩ (Effectively Random, Estimation Result, Entity Relationship) diagram is a graphical representation of a database structure**.** The level of detail in these diagrams

⟨can vary⟩ (cannot change, never changes, can vary).

The term ⟨entity⟩ (element, entity, essence) is used to describe the object about which

information is stored. They are connected by lines that represent ⟨relationships⟩

(relationships, graphs, concepts). For each object we define ⟨attributes⟩ (attributes, algorithms, alternatives) that contain the relevant pieces of information.

Maks poeng: 5

13 Properties of Transactions

Select the correct definition for each term:

Atomicity:
| All or none of the sub-operations of a transaction must be completed. |

(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:
| A transaction moves the database from one valid state to another valid state. |

(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., All or none of the sub-operations of a transaction must be completed., The effect of transactions in progress should not be observable by other transactions.)

Isolation:

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

Durability:

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

Maks poeng: 4

14 Database Life Cyle

Select the correct items and put them in the right order:

Interpretation

System Compilation

Deconstruction

1: Preliminary Study

2: Requirements Analysis

3: Design

4: Implementation

5: Testing

6: Production

7: Maintenance

Maks poeng: 6

Game Platform Data Model

In this exercise, you work on a database for a game review platform.
The database contains several entities:

- Users(__UserID__, NickName, EmailAddress, RegistrationDate)
- Games(__GameID__, GameName, Genre, Description, PublisherID*, MinNumberPlayers, MaxNumberPlayers, Price, ReleaseDate)
- Reviews(__ReviewID__, UserId*, GameID*, Rating, ReviewText, ReviewDate)
- Publishers(__PublisherID__, PublisherName, Address, DateEstablished)

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

15 Diagram

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

⌨ Hjelp
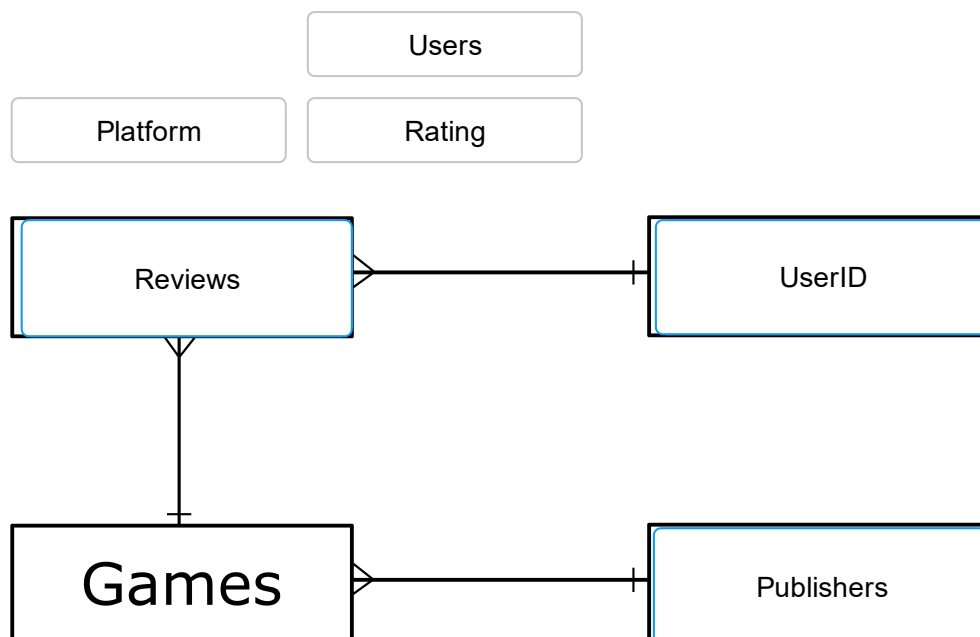
Maks poeng: 3

16 **Query 1**

Place the tokens in the gaps in the query below so that it returns the average rating of games for 6 or less players.

⌨ Hjelp

MinNumberPlayers	SUM	Reviews

Games.GameID

Users

SELECT   [AVG]   (Reviews.Rating)

FROM Reviews

INNER JOIN   [Games]

WHERE   [Games.MaxNumberPlayers]   <= 6

Maks poeng: 1.5

17 Query 2

Place the tokens in the gaps in the query below so that it returns the genre name and the average price of games in each genre, and shows this in increasing order of average price.

⌨ Hjelp

| Price | AveragePrice DESC | Reviews |

| Price/(TotalNumberOfGenres) |

| GameID |

SELECT Genre, [AVG(Price)] AS [AveragePrice]

FROM [Games]

GROUP BY [Genre]

ORDER BY [AveragePrice ASC]

Maks poeng: 2.5

18 Algebra 1

Translate the following query into relational algebra:

SELECT Games.GameName, Reviews.Rating
FROM Games INNER JOIN Reviews ON Games.GameID = Reviews.GameID

Complete the expression below:

⌨ Hjelp

ReviewID		=
σ	×	
UserID		

Π GameName, Rating (Games ⋈ Games.GameID =

Reviews.GameID   Reviews   )

Maks poeng: 2

19 Algebra 2

Translate the following query into relational algebra:

SELECT *
FROM Games
WHERE MinNumberPlayers > 4

Complete the expression below:

⌨ Hjelp

| × | Publisher | Users |
| Π | | |

σ MinNumberPlayers > 4 (Games)

Maks poeng: 1

Normalization Exercise

The table *FoodOrders* contains data about orders placed by clients of a Restaurant.

FoodOrder(Date, Time, FoodItemName, FoodCategoryNumber, FoodCategoryName, FoodPrice, CustomerNumber, CustomerName, SpecialRequest, Tip)

The example row below tells us that a customer named Martin with CustomerNumber 27751 ordered a curry with rice on 21st of May 2023 at 14:36:11. The customer made a special request to get a dish without nuts and gave 25 NOK in tip. The price of the curry is 220 NOK. The category of the dish is vegan and the category number is 10.

FoodOrder('2023-05-21', '14:36:11', 'Curry with Rice', 10, 'Vegan', 220, 27751, 'Martin', 'Without nuts.', 25)

The smallest time interval used here is the second.
Multiple orders can be placed at the same time, but not by the same customer.

Answer all six of the questions below.

Note: You must indicate primary keys by <u>underlining</u> 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 → B.

<u>Do not introduce new columns.</u>

<u>If you make any additional assumptions, you must clearly state them.</u>
<u>You can write the assumptions in the last text field of the exam.</u>

20 Redundancy

This table contains redundancy. **Give <u>one</u> example of this (maximum 12 words)**.

Fill in your answer here

CustomerNumber and CustomerName are redundant. you only need CustomerNumber.

Ord: 9

Maks poeng: 2

21 **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

CustomerNumber -> CustomerName
FoodItemName -> FoodCategoryNumber
FoodCategoryNumber -> FoodCategoryName
FoodItemName -> FoodPrice
CustomerNumber -> SpecialRequest
CustomerNumber -> Tip

Ord: 18

Maks poeng: 6

22 **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:

- ☑ Date

- ☑ Time

- ☐ FoodItemName

- ☐ FoodCategoryNumber

- ☐ FoodCategoryName

- ☐ FoodPrice

- ☑ CustomerNumber

- ☐ CustomerName

- ☐ SpecialRequest

- ☐ Tip

Maks poeng: 2

23 **Types of dependencies**

Which of these types of dependencies occur in the table ?

Note: Select all that apply.

Select one or more alternatives:

- ☑ Partial dependencies

- ☐ A determinant that is not a super-key

- ☑ Transitive dependencies

Maks poeng: 3

24 **Normal Form**

Which are the normal forms verified by the table ?

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

- ☐ Third Normal Form

- ☐ Second Normal Form

- ☑ First Normal Form

Maks poeng: 2

25 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

Menu(FoodItemName, FoodCategoryNumber*, FoodPrice)
FoodCategory(FoodCategoryNumber, FoodCategoryName)
Customer(CustomerNumber, CustomerName)
Order(Date, Time, CustomerNumber*, FoodItemName*, SpecialRequest, Tip)

Ord: 13

Maks poeng: 5

26 Mandatory Assignments

Below, 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

when normalizing the table in exam question number 25 i made the assumption that a customer could only order one item at a time.

Maks poeng: 30