**​​1DV503/1DT903 Database Technology and Modeling**

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## **1DV503**

### **Task 1. The Hospital database (25 points)**

***1.1******Identify all entities and their attributes from the description of database requirements using the following Table template:***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Entitet | Attribut | Attributtyp | Nyckelattribut | Värde (typ, NULL/NOT NULL) |
| DEPARTMENT | Department ID  Name  Head Physician ID | Simple  Simple  Simple | True  False  False | Integer, not null, unique  String, not null  Integer, not null |
| PHYSICIAN | Physician ID  Name  Phone Number  Address | Simple  Simple  Simple  Simple | True  False  False  False | Integer, not null, unique  String, not null  String, not null  String, not null |
| PATIENT | Patient ID  Name (First name and lastname)  Adress  Phone Number  Insurance Code | Simple  Simple  Simple  Simple  Simple | True  False  False  False  False | Integer, not null, unique  String, not null  String, not null  String, not null  String, not null |
| NURSE | Nurse ID  Name  Phone Number  Specialization | Simple  Simple  Simple  Simple | True  False  False  False | Integer, not null, unique  String, not null  String, not null  String, not null |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| APPOINTMENT | Appointment ID  Start Date  End Date  Patient ID  Physician ID  Nurse ID  Room Number | Simple  Simple  Simple  Simple  Simple  Simple  Simple | True  False  False  False  False  False  False | Integer, not null, unique  Date, not null  Date, not null  Integer, not null  Integer, not null  Integer, not null  Integer, not null |
| ROOM | Room Number  Type  Availability | Simple  Simple  Simple | True  False  False | Integer, not null, unique  String, not null  String, not null |
| MEDICATION | Medication IDID  ATC Code  Name  Type (till exempel piller, droppar, kräm)  Description | Simple  Simple  Simple  Simple  Simple | True  False  False  False  False | Integer, not null, unique  String, not null  String, not null  String, not null  String, null |
| PROCEDURE | Procedure Code  Name  Cost | Simple  Simple  Simple | True  False  False | Integer, not null, unique  String, not null  Numeric, not null |
| TEST | Test ID  Date  Type (for exempel COVID-test, allergitest, etc.)  Result | Simple  Simple  Simple  Simple | True  False  False  False | Integer, not null, unique  Data, not null  String, not null  String, not null |

***1.2 Identifying the relationship between entity sets using the following table template:***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Entitet A | Relationen **name** | Entitet B | Cardinality Ration  (1:1,1:N,N:1,M:N) | **Attribute of Relationship Types** | **Justify your decision** |
| DEPARTMENT | Heads | Physician | 1:1 | None | Each department has a chief physician |
| DEPARTMENT | BELONGS\_TO | Physician | N:1 | None | Doctors are placed in a ward. |
| PHYSICIAN | Makes | APPOINTMENT | 1:N | None | A doctor can make many appointments. |
|  |  |  |  |  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| PHYSICIAN | PRESCRIBES\_PROCEDURE | PROCEDURE | 1:N | None | A doctor can prescribe many procedures. |
| PHYSICIAN | PRESCRIBES\_MEDICATION | MEDICATION | 1:N | Recepttid | A doctor can prescribe many medications with duration. |
| NURSE | ASSISTS | APPOINTMENT | 1:N | None | A patient can have many appointments. |
| Patinet | takes | TEST | 1:N | None | A patient can take many tests. |
| Patinet | UNDERGOES | PROCEDURE | 1:N | None | A patient can undergo many procedures |
| NURSE | ASSISTS | APPOINTMENT | 1:N | None | nurse can help with many bookings |
| Room | HOSTS | APPOINTMENT | 1:N | None | One room can host many bookings. |

***1.3 Design an ER schema for hospital database based on information provided in task 1, and entities defined in 1.2 with relationships defined in 1.3.***

The ER schema should contain entities with their corresponding attributes, key attributes of each entity, relationship types, and their corresponding cardinality ratio.

En bild som visar text, skärmbild, diagram, elektronik

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**En bild som visar text, skärmbild, elektronik, programvara

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**En bild som visar text, skärmbild, Multimedieprogram, programvara

Automatiskt genererad beskrivning**

### **Task 2 Conference Review Database (25 points)**

***2.1******Identify all entities and their attributes from the description of Conference review database requirements using the following Table template:***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Entity | Attribute | Attribute Type | Key Attribute | Value type of attribute (type, min, max, unique, NULL/NOT NULL) |
| Author | Email  First Name  Last Name  Affiliation  Country | Simple  Composite  Composite  Composite  Simple | True  False  False  False  False | String, unique, not null  String, not null  String, not null  String, not null  String, not null |
| Paper | Paper ID  Title  Abstract  Keywords  Year  Electronic\_File Name  Corresponding Author | Simple  Simple  Simple  Multivalued  Simple  Simple  Simple | True  False  False  False  False  False  False | Integer, unique, not null  String, not null  String, not null  String, not null  Integer, not null  String, unique, not null  String, not null |
| Reviewer | Email  First Name  Last Name  Phone Number  Affiliation  Topics of Interest | Simple  Composite  Composite  Simple  Composite  Multivalued | True  False  False  False  False  False | String, unique, not null  String, not null  String, not null  String, not null  String, not null  String, not null |
| Review | Review ID  Paper ID  Reviewer Email  Technical Merit  Readability  Originality  Relevance  Internal Comment  Author Feedback | Simple  Simple  Simple  Composite  Composite  Composite  Composite  Simple  Simple | True  False  False  False  False  False  False  False  False | Integer, unique, not null  Integer, not null  String, not null  Integer, 1-10, not null  Integer, 1-10, not null  Integer, 1-10, not null  Integer, 1-10, not null  String  String |

***2.2 Identifying the relationship between entity sets using the following table template:***

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Entity A | Participation Entity A | Relationship name | Particpiaiton  Entity B | Entity B | Cardinality Ration  (1:1,1:N,N:1,M:N) | Attribute of Relationship Types | Justify your answer |
| Author | Total | Writes | Partial | Paper | M:N | AuthorID, PaperID | A paper is reviewed by multiple reviewers, but reviewers can review multiple papers. |
| Paper | Total | Assigned To | Partial | Reviewer | M:N | PaperID, ReviewerEmail | Each paper is reviewed by 2-4 reviewers, reviewers can review multiple papers. |
| Reviewer | Total | Reviews | Partial | Review | 1:N | ReviewerEmail, ReviewID | A reviewer can write multiple reviews, but each review is associated with only one reviewer. |
| Paper | Total | Is Reviewed In | Total | Review | 1:N | PaperID, Review ID | A paper can have multiple reviews, but each review is associated with only one paper. |

***2.3 Design an ER schema for review database based on information provided in task 2, and entities defined in 2.1 with relationships defined in 2.2.*** You are free to make additional assumptions if you feel that some information is missing. Make sure to **document** **all assumptions** that you make. Please justify your assumptions.

**En bild som visar text, skärmbild, diagram, elektronik

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### **Task 3. Bank database (25 points)**

Consider the ER diagram shown below for part of a BANK database. Each bank can have multiple branches, and each branch can have multiple accounts and loans. Provide answers on the following statements:

1. List a strong (nonweak) entities in the ER diagram

**Answer: Bank**

1. Is there a weak entity? If so, give its name, partial key, and identifying relationship (owner entity)

**Answer:** BANK\_BRANCH is a weak entity with the "Branch\_no" serving as a discriminator or partial key within the context of the owning BANK entity, identified by "Code". The identifying relationship is "Has\_Branches".

1. What constraints do the partial key and the identifying relationship (owner) of the weak entity have in this diagram

**Answer:** Partial Key Constraint: The "Branch\_no" must be unique for each BANK\_BRANCH only within a single BANK. It does not have to be unique across all banks. So, two different banks could each have a branch with the same "Branch\_no", but one bank cannot have two branches with the same number.

Identifying Relationship (Owner) Constraint: The "Has\_Branches" relationship means that:

Every BANK\_BRANCH must be connected to a BANK. A branch cannot exist without being part of a bank.

If you delete a BANK, you also delete all of its BANK\_BRANCHes.

In other words, each branch's identity depends on the bank it belongs to, and each branch number is only unique within its own bank.

1. List the names of all relation (entity) and specify the (min, max) constraint using the total/partial participation of an entity in a relationship (on both sides of the relation: left and right). Justify your answer.

| **Entity name** | **Relationship name** | **(min, max)** | **Justify your answer** |
| --- | --- | --- | --- |
| Bank | Has\_Branches | (1, N) | A bank must have at least one branch (total participation), but there is no upper limit to the number of branches it can have. This is shown by the single line (indicating participation) and the 'N' (indicating many) next to the Bank in the Has\_Branches relationship. |
| Bank Branch | Has\_Branches | (1, 1) | A bank branch must be associated with exactly one bank (total participation and existence dependency), shown by the double line (indicating total participation) connecting the Bank Branch to the Has\_Branches relationship. |
| Bank Branch | Has\_Accounts | (0, N) | A bank branch may have zero or many accounts. The 'N' indicates that there can be many accounts, but the lack of a double line indicates that it is not mandatory for a branch to have any accounts (partial participation). |
| Account | Has\_Accounts | (1, 1) | An account must be associated with exactly one bank branch. This is shown by the single line connecting the Account to the Has\_Accounts relationship, indicating total participation of each account. |
| Bank Branch | Loans | (0, N) | A bank branch can have zero or many loans issued. The 'N' indicates that there can be many loans, but the lack of a double line indicates that not every branch has to have a loan (partial participation). |
| Loan | Loans | (1, 1) | Each loan must be associated with exactly one bank branch, shown by the single line connecting Loan to the Loans relationship, indicating that every loan is issued by one branch (total participation). |
| Customer | A\_C | (0, N) | A customer can have zero or many accounts, indicated by the 'N' and the lack of a double line, which means it's not mandatory for a customer to have an account (partial participation). |
| Account | A\_C | (1, M) | An account can be associated with one or many customers, indicated by the 'M'. The single line suggests that while an account must be associated with at least one customer, it could be a joint account with many (total participation). |
| Customer | L\_C | (0, N) | A customer can have zero or many loans, as indicated by the 'N' and the absence of a double line, meaning a customer is not required to have a loan (partial participation). |
| Loan | L\_C | (1, M) | A loan can be associated with one or many customers, indicated by the 'M'. The single line suggests that while a loan must be associated with at least one customer, it could be a joint loan with many (total participation). |

### **Task 4. Airport Management database (25 points)**

***4.1******Given the constraints shown in the ER schema below, respond to the following statements with True, False, or Maybe.***

|  |  |  |  |
| --- | --- | --- | --- |
| **N** | **Statement** | **True/False/Maybe** | **Justify your answer** |
| 1 | Every pilot has been a passenger in some flight. | **Maybe** | The ER diagram shows that a pilot is a type of passenger. However, it doesn't specify whether all pilots have been passengers on a flight. |
| 2 | Every flight has at least one deadheading pilot. | **False** | According to the ER diagram, a flight may have zero or more deadheading pilots (indicated by the 'N' which can also be zero). |
| 3 | Every flight has at least 2 pilots. | **Maybe** | The ER diagram shows that pilots are associated with flights, but it doesn't specify the minimum number of pilots required for a flight. |
| 4 | Every pilot has flown at least 2 times. | **Maybe** | The ER diagram does not provide information about the number of times a pilot has flown. |
| 5 | There are tickets that do not belong to any flight | **False** | The ER diagram explicitly shows that each ticket belongs to exactly one flight (1-to-N relationship). |
| 6 | Some airline does not have flights | **True** | The ER diagram indicates that an airline may have zero or more flights (1-to-N relationship, where N can be zero). |
| 7 | Some flight does not have assigned aircraft | **False** | The ER diagram shows that every flight is assigned exactly one aircraft (1-to-1 relationship). |
| 8 | Each flight has a departure and arrival airport assigned | **True** | The ER diagram shows a 1-to-N relationship between flights and airports for both departure and arrival, meaning each flight has one departure and one arrival airport. |
| 9 | A passenger can be a pilot | **True** | The ER diagram shows that a pilot is a type of passenger (a pilot "is a" passenger), therefore a passenger can be a pilot. |
| 10 | Passengers can buy one ticket for the flight | **Maybe** | The ER diagram shows that a passenger can book 'N' tickets, but it doesn't specify if there is a limit to one ticket per flight. |
| 11 | There are tickets that do not have a class type (Economy, Business, etc.) | **Maybe** | The ER diagram links tickets with class but does not specify if a class is mandatory for every ticket. |
| 12 | There are some tickets without payment | **False** | The ER diagram shows a 1-to-1 relationship between tickets and payments, indicating each ticket must have a payment. |
| 13 | There are some flights without tickets | **True** | The ER diagram shows a 1-to-N relationship between flights and tickets, which allows for the possibility of flights without tickets (where N can be zero). |
| 14 | There are some aircraft that are not assigned to a flight | **True** | The ER diagram shows that an aircraft may or may not be assigned to a flight (1-to-N relationship, where N can be zero). |
| 15 | Some airlines do not have any flights. | **True** | The ER diagram shows a 1-to-N relationship between an airline and flights. This means that an airline can have zero (N can be zero) or more flights, allowing for the possibility that some airlines may not have any flights. |