UIS Assignment 1

Mikkel AH Rasmusen HBS145
Benjamin Egelund-Müller SDV824
Marius Balslev Samson QSV426
Martin Thiele MQN507

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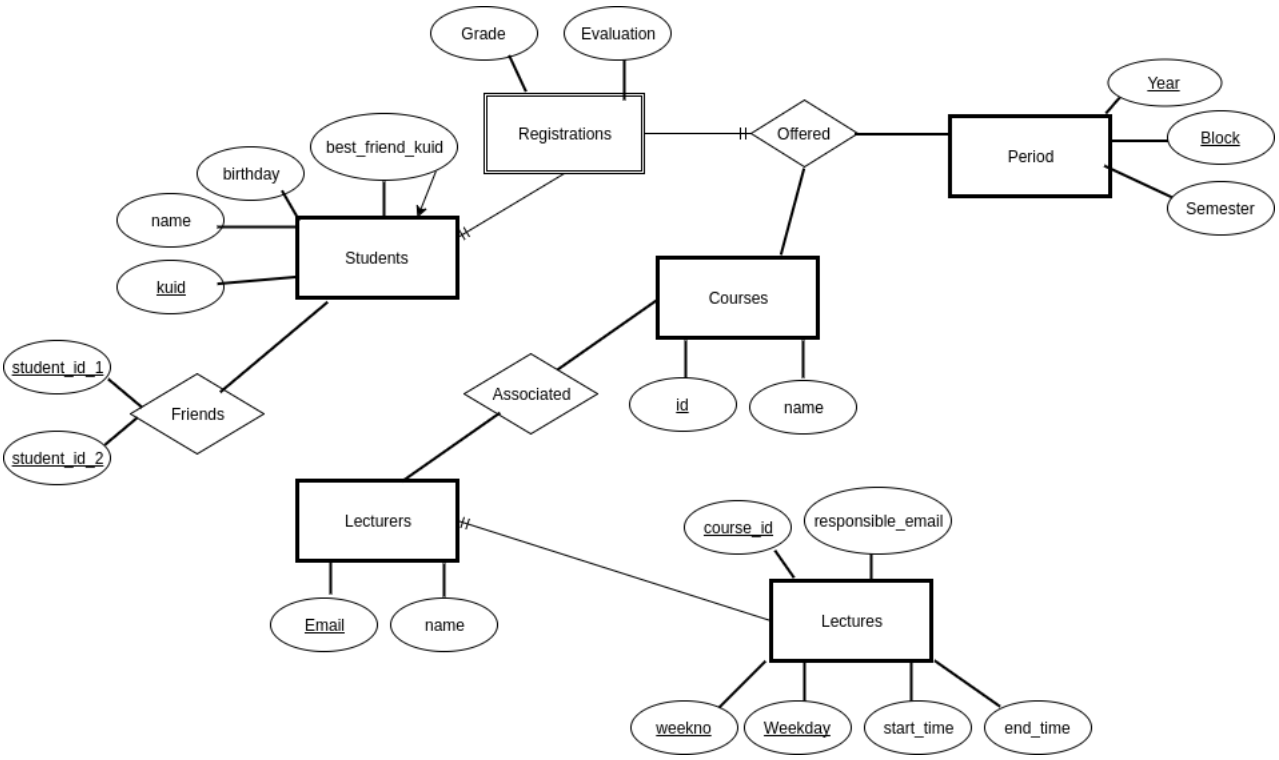
1 Conceptual Modeling



Figur 1: ER diagram of the socialcourses.dk's database.

Seperately Expressed Constraints

The "course_id"attribute of Lectures must have a corresponding Course entity with that "id"attribute.

2 ER-to-Relational Mapping

```
CREATE TABLE students(
  kuid           CHAR(6),
  name           VARCHAR,
  birthday       DATE,
  best_friend_kuid CHAR(6) REFERENCES students(kuid),
  PRIMARY KEY (kuid)
);

CREATE TABLE friends(
  student_id_1 CHAR(6) REFERENCES students(kuid),
  student_id_2 CHAR(6) REFERENCES students(kuid),
  PRIMARY KEY (student_id_1, student_id_2)
);

CREATE TABLE courses(
  id   INT,
  name VARCHAR,
  PRIMARY KEY (id)
);

CREATE TABLE period(
  year     INT,
  block    INT,
  semester BOOLEAN, /* For courses streching two blocks */
  PRIMARY KEY (year, block, semester)
);

CREATE TABLE offered(
  course_id INT REFERENCES courses(id),
  year      INT,
  block     INT,
  semester  BOOLEAN,
  FOREIGN KEY (year, block, semester) REFERENCES period(year, block, semester),
  PRIMARY KEY (course_id, year, block, semester)
);

CREATE TABLE registration(
  student_id CHAR(6) REFERENCES students(kuid),
  course_id  INT REFERENCES courses(id),
  year       INT,
  block      INT,
  semester   BOOLEAN,
  evaluation INT,
  grade      INT,
  FOREIGN KEY (course_id, year, block, semester) REFERENCES offered(course_id,
  year, block, semester),
  PRIMARY KEY (student_id, course_id)
 );

CREATE TABLE lecturers(
  email VARCHAR(100),
  name  VARCHAR(100),
  PRIMARY KEY (email)
);

CREATE TABLE associated(
  course_id        INT REFERENCES courses(id),
  lecturer_email VARCHAR(100) REFERENCES lecturers(email),
  PRIMARY KEY (course_id, lecturer_email)
```

```
);

CREATE TABLE lectures(
  lecture_id  INT,
  course_id   INT REFERENCES courses(id),
  responsible_email VARCHAR(100) REFERENCES lecturers(email),
  weekno      INT, /* ISO 8601 */
  Weekday     INT, /* Mon = 1, Tue = 2, ... */
  start_time  TIME,
  end_time    TIME,
  PRIMARY KEY (course_id)
);
```

3 Relational Algebra

a) Listing all courses taught by Fritz Henglein:

$$\Pi_{\texttt{course\_id}}(\sigma_{\texttt{lecturer\_email="henglein@diku.dk"}}(\texttt{associated}))$$

b) Let x the user ID of the writer. Listing pairs of courses taken by x that share a teacher.

$$S1 = \Pi_{\texttt{course\_id,lecturer\_email}}(\sigma_{\texttt{students\_id=x}}(\texttt{registration} \bowtie_{\texttt{course\_id}} \texttt{associated}))$$
$$S2 = \Pi_{\texttt{course\_id,lecturer\_email}}(\sigma_{\texttt{year=2017}\wedge(\texttt{block=3}\vee\texttt{block=4})}(S1 \bowtie_{\texttt{course\_id}} \texttt{offered}))$$
$$S3 = \rho_{\texttt{other\_course\_id/course\_id}}(S2)$$

Now, the desired result is achieved with:

$$\Pi_{\texttt{course\_id,other\_course\_id}}(\sigma_{\texttt{course\_id}\neq\texttt{other\_course\_id}}(S2 \bowtie_{\texttt{lecturer\_email}} S3))$$

c) Listing periods that are fully booked. Getting number of teachers:

$$x = \gamma_{\texttt{COUNT(lecturer\_email)}}(\texttt{lecturers})$$

Getting number of teachers teaching in each period:

$$S1 = \gamma_{\texttt{year,block,semester,COUNT(lecturer\_email)}\rightarrow\texttt{count\_teachers}}(\texttt{associated} \bowtie_{\texttt{course\_id}} \texttt{offered})$$

Listing periods where all teachers are teaching:

$$\Pi_{\texttt{year,block,semester}}(\sigma_{\texttt{count\_teachers=x}}(S1))$$

d) Listing courses that the writer (who has ID x and John's (who has ID y) best friend have both signed up for this semester. First, getting courses taken by the writer this semester:

$$S1 = \Pi_{\texttt{course\_id}}(\sigma_{\texttt{students\_id=x}\wedge\texttt{year=2017}\wedge(\texttt{block=3}\vee\texttt{block=4})}(\texttt{registration}))$$

Next, getting courses taken by John's best friend this semester:

$$S2 = \Pi_{\texttt{course\_id}}(\sigma_{\texttt{id=y}\wedge\texttt{year=2017}\wedge(\texttt{block=3}\vee\texttt{block=4})}(\texttt{students} \bowtie_{\texttt{best\_friend\_id=students\_id}} \texttt{registration}))$$

Finally, getting intersection of the writer's and John's courses this semester:

$$\Pi_{\texttt{course\_id,name}}((S1 \cap S2) \bowtie_{\texttt{course\_id=id}} \texttt{courses})$$

e) Let x be the ID of the writer. Getting friends:

$$S1 = \Pi_{\texttt{student\_id\_2}}(\sigma_{\texttt{student\_id\_1=x}}(\texttt{friends}))$$

Getting friends of friends:

$$S2 = \Pi_{\texttt{student\_id\_2}}(\rho_{\texttt{source\_student\_id/student\_id\_2}}(S1) \bowtie_{\texttt{source\_student\_id=student\_id\_1}} \texttt{friends})$$

Getting extended friends

$$S3 = S1 \cup S2$$

Getting courses taken by the writer this semester (similar to **d**):

$$S4 = \Pi_{\texttt{course\_id}}(\sigma_{\texttt{students\_id=x} \wedge \texttt{year=2017} \wedge ((\texttt{block=3} \wedge \texttt{semester=T}) \vee \texttt{block=4})}(\texttt{registration}))$$

Getting courses taken by the extended friends this semester:

$$S5 = \Pi_{\texttt{student\_id,course\_id}}(\sigma_{\texttt{year=2017} \wedge ((\texttt{block=3} \wedge \texttt{semester=T}) \vee \texttt{block=4})}(S3 \bowtie_{\texttt{student\_id}} \texttt{registration}))$$

Getting names of extended friends taking the same courses as the writer:

$$\Pi_{\texttt{name}}(\texttt{students} \bowtie_{\texttt{id=student\_id}} \Pi_{\texttt{student\_id}}(S4 \bowtie_{\texttt{course\_id}} S5))$$

4 1st MUST Report

Initial comments

The situation of our project has been a little precarious, as the company which we were intending to cooperate with has not yet won the bid for the project. After speaking to Peter Carstensen, we have elected to continue as a "start-up project", and if the design bureau wins the bid, we will merge our team with theirs and continue the project as a traditional "consulting-style"project.

The design bureau which we have been in dialogue with is Kvorning Design & Kommunikation, `http://www.kvorning.dk/`.

a - Description of Organisation

Since we are currently working as a start-up, we are not working directly for a company. The intended customers of the system we are developing could be very diverse, including museums, exhibitions, municipalities, companies with geographical representation, etc.

b - Project Charter

Terminology

Client will refer to a company/institution which is running the system. It may also refer to a user in an administrative role, acting on behalf of this company/institution.
End user will refer to a customer/user which is interacting with the system (as hosted by the client) in a non-administrative role.

Definition of the Assignment

The idea of the project consists in developing an interactive graphical map. The core feature of the system will be the ability for the client to enter data and coordinates through a graphical interface to a relational database. These entries will show up as icons on the map. When an end user interacts with the map, pressing one of the icons will open a window showing additional information fetched from the database.

Stakeholders

- The client organisation/company
- Data-entry employees
- System admins

- End users
- Focus group

Since we are following the start-up model, our client is currently only hypothetical. For this reason our current stakeholder analysis will focus on general organisational patterns and the end-users of the product.

On the client level, we have identified the **data-entry workers**, who will be utilizing our CMS to edit the content of the system, to be the main stakeholder. They would have an interest in ensuring that the design is usable and efficient for their problem domain.
Additionally, **system administrators** will have an interest in ensuring the maintainability of the product.
The **client organization or company as a whole** will be motivated to have as efficient an implementation as possible, in order to minimize the hardware expenses required to use the product.

End users will be interested in an approachable, usable interface, as well as an efficient (smooth) implementation. This is one of the few stakeholders who we can currently have a dialogue with, as the intended system is meant for general use. We plan to do this by hosting focus groups, and eventually performing usability testing when we have a working prototype.

Method

During this it project, we expect to take the following development/design methods in use:

- The MUST design process
- PACT analysis
- Agile development method
- BATOFF

The **MUST** design process:
Throughout the development of this it project we will be following the MUST design process for participatory it design. In section "d"we describe how we plan to apply each of the four principles of the MUST method to our project development.

PACT analysis:
In the early stages of development we will be doing a PACT analysis of our project to get a better understanding of the nature of this particular project, such as what kind of people this project will affect - and how, as well as which technologies might be suitable to take in use for this project.

Agile method:
Our development method for this project will be agile, meaning we will make several iterations of the product, updating it in small increments.

BATOFF:
To establish the scope of our project we will follow "BATOFF", looking at conditions, application area, technology, objects, functionality, and philosophy.

c - Initial Limitation of Scope

As the focus of this class is on project management and database design, we will not put emphasis on the visual presentation; any graphical elements will be minimalist/placeholders.

The hardware implementation of the system also lies outside the scope of our project.

d - Reflection on MUST Principles

Our planned application of the MUST principles will be described in view of our current situation as a start-up project. If Kvorning Design & Kommunikation wins the bid, we will reevaluate these with our new access to their client in mind.

Coherent Vision

By implementing the system using SQL, interfacing with potential clients' current work processes should ideally be relatively straightforward.
If the potential client is a smaller organization or company which do not currently use any databases, the CMS which we are developing will allow the client's data-entry workers to use the system without prerequisite in-depth IT knowledge.

Genuine User Participation

Using an agile development method, we aim to develop early prototypes and perform usability testing before iterating on the design based on their feedback.
The CMS part of the system is intended to be used by users with limited, non-specific IT skills, we can test this functionality without direct access to the employees of potential clients.
End-users can similarly be sampled from the general population.

Firsthand Experience

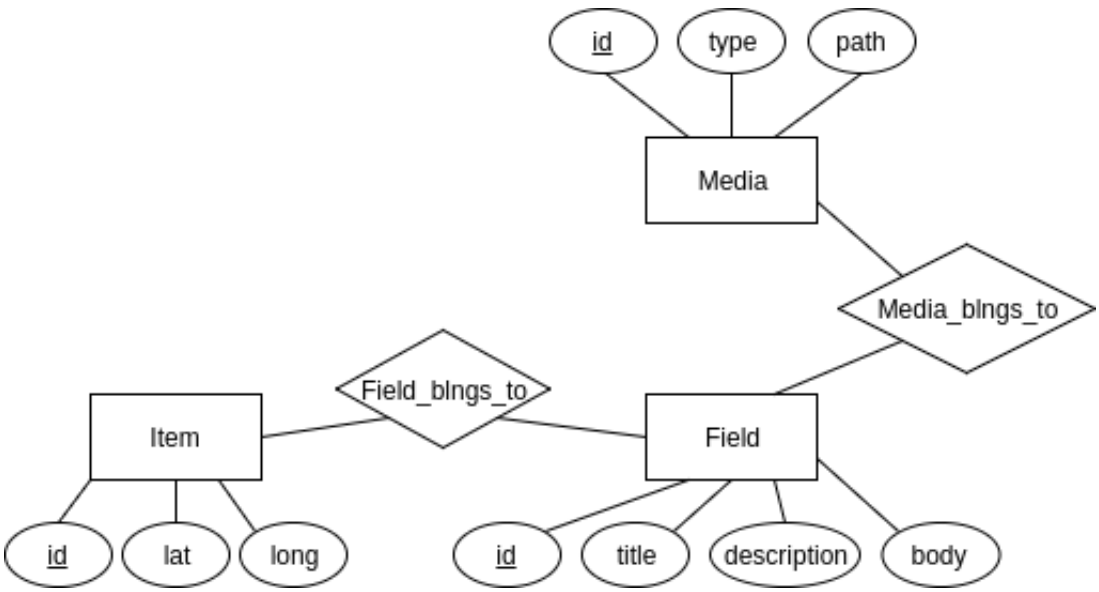
Since we are not replacing existing IT functionality in an organization, it is not possible to observe existing practices.
Members of the design group already have experience working with custom CMS's, so there is already some measure of firsthand experience present in the group.

Anchoring Visions

As we are currently not working directly with a client, we can not anchor our vision with them.

e - ER Diagram of Problem Domain

Diagram



Figur 2: ER diagram of our project.

Explanation

We have modeled the problem domain with the following entities and relations:

- Item - Entity
- Field - Entity
- Media - Entity
- Field_blngs_to - Many-to-many relation
- Media_blngs_to - Many-to-many relation

The motivation to make ”Field_blngs_to”a many-to-many relation is that a client could wish to show the same field with the same content on multiple Items (the same applies for the ”Media_blngs_to”relation). The relation will contain a listing of Item IDs and Field IDs, which allows for an item to have a variable amount of fields.

We discussed whether Media should be related to Item or Field, which would influence whether images and videos showed up ”gallery style”as a seperate functionality to the fields, or as a Field like all other entries. In the end we decided to make the relation between Field and Media, as this will allow separate categories of images and videos, if the client wishes to distinguish between them.

While we were hesitant to make latitude and longitude (”lat”and ”long”) primary keys since they will be floating point number and thus subject to some inaccuracy, they will need to be unique in the database, in order to avoid problems when end-users attempt to click a point on the map.

5 Addendum - Email Correspondence

```
On 16 Feb 2017, at 15:47, Mikkel <mikkel@rasmusen.dk> wrote:
Hej Christopher,
Her er vores kursusbeskrivelse:
https://kurser.ku.dk/course/ndab16009u/2016-2017
Fokus for kurset er at forsøge at analysere brugerens behov, afgrænse problemområdet og designe en
    løsning, der indeholder "ikke-trivielle" ændringer til et SQL databasesystem - i det her tilfælde
    ville oprettelsen af en helt ny database helt sikkert tælle som ikke-trivielt.
De andre i gruppen er åbne for også at arbejde med brugergrænsefladen, og vores instruktor synes også
    at en analyse af det kunne være en interessant tilføjelse til projektet, så det kan godt være jeg
    var lidt for tilbageholdende omkring det da vi talte sammen.
Jeg tror relativt hurtigt vi kunne få databasen og CMS'et til det sat op, og så gå videre og arbejde
    med det grafiske efterfølgende.
Venlig hilsen Mikkel Rasmusen

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On Thu, 16 Feb 2017 16:02:02 +0100
Chris <chris@kvorning.dk> wrote:
Hej Mikkel
Det lyder rigtig godt, og kunne sagtens spille sammen med opgaven der ligger foran os.
Mere præcist kan jeg måske uddybe lidt om det færdige produkt.
       - Skal indeholde 3 sprog, der aktivt kan skiftes imellem
              - Her er det fordelagtigt hvis (når det nu bliver lavet i web teknologi), at man måske
                  indtænker noget AJAX, hårde overgange er
              ikke at fortrække, så ved valg af nyt sprog må det gerne ske flydende. (Det KAN ske, at
                  man blot vælger sprog ved aktivering af installation)
       - CMS system til at ændre tekst og billeder ved hvert punkt. (Skal være tilgængeligt for ikke
           tekniske personer)
              - Indhold i CMS kunne bl.a. være: Billeder, Film, Overskrift, Beskrivelse, Brødtekst (
                  Hvis der er for mange billeder, kan man evt. swipe igennem dem)
       - Ved opstart, loades en .json/.xml/.csv fil og placerer de forskellige spots på kortet.
              monument.dk <http://monument.dk/>
       - Systemet bliver bygget til EN browser (Chrome højst sandsynligt) og kun EN touchskærm, der
           skal derfor ikke tages højde for om hvorvidt det er responsivt.
       - Brugerflade elementer til front-end bliver leveret af Kvorning
       - Opsætning af Hardware bliver klaret af Kvorning
```

Det er værd at bemærke kunden er opmærksom på hvor flydende en oplevelse det bliver.
Bedste hilsner/Best regards
Christopher Lassen
Interaktions Designer

On Thu, 16 Feb 2017 22:41:22 +0100
"Mikkel" <mikkel@rasmusen.dk> wrote:
Hej Christopher,
Jeg synes det lyder spændende, og jeg sender den nye information videre til de andre gruppemedlemmer.
Vi krydser fingre for at i får opgaven :)
Venlig hilsen Mikkel Rasmusen

On 27 Feb 2017, at 14:50, Mikkel <mikkel@rasmusen.dk> wrote:

Hej Christopher,
Jeg ville lige høre om der var noget nyt?
Vi skal udarbejde løbende statusrapporter, og den første er ved at nærme sig, så det ville være rart
    at kunne be- eller afkræfte om det bliver dette projekt vi skal arbejde med.

Venlig hilsen Mikkel Rasmusen

Hej Mikkel

Vi har desværre intet hørt endnu vedr. opgaven, og har ikke noget klart bud på hvornår vi får et svar,
da den endelige deadline ligger langt ude i fremtiden, er det også svært at spå om.

Jeg skal nok give jer besked så snart jeg ved noget nyt, og bliver i nød til at tage en anden case,
så skal i endelig bare gøre det.

Bedste hilsner/Best regards

Christopher Lassen
Interaktions Designer