Martin Svoboda

Homepage Publications Projects Teaching

B0B36DBS: Database Systems

Basic Information

- Annotation: B0B36DBS (full-time study)
- Lecturer: **Martin Svoboda**
- Tutors: **Jana Ahmad**, **Radomír Černoch**, **Martin Řimnáč**, **Martin Svoboda**, **Gustav Šourek**
- Schedule: B0B36DBS
- Lectures:
  - **Tuesday 9:15 - 10:45 (KN:E-107)**
- Practical classes:
  - Group 111 - Jana Ahmad: **Tuesday 12:45 - 14:15 (KN:E-310)** (conducted in English)
  - Group 101 - Martin Svoboda: **Tuesday 12:45 - 14:15 (KN:E-307)**
  - Group 102 - Martin Svoboda: **Tuesday 14:30 - 16:00 (KN:E-307)**
  - Group 103 - Martin Svoboda: **Tuesday 16:15 - 17:45 (KN:E-307)**
  - Group 104 - Martin Svoboda: **Tuesday 18:00 - 19:30 (KN:E-307)**
  - Group 109 - Radomír Černoch, Gustav Šourek: **Wednesday 12:45 - 14:15 (KN:E-328)**
  - Group 110 - Radomír Černoch, Gustav Šourek: **Wednesday 14:30 - 16:00 (KN:E-328)**
  - Group 105 - Martin Řimnáč: **Thursday 12:45 - 14:15 (KN:E-331)**
  - Group 106 - Martin Řimnáč: **Thursday 14:30 - 16:00 (KN:E-331)**
  - Group 107 - Martin Řimnáč: **Thursday 16:15 - 17:45 (KN:E-331)**
  - Group 108 - Martin Řimnáč: **Thursday 18:00 - 19:30 (KN:E-331)**
- Table with points from practical classes, homework assignments and exam tests

Lectures

- Tuesday 20. 02. 2018: **01 - Conceptual Modeling**
- Tuesday 27. 02. 2018: **02 - Relational Model**
- Tuesday 06. 03. 2018: *Canceled*
- Tuesday 13. 03. 2018: **03 - SQL: Data Definition**
- Tuesday 20. 03. 2018: **04 - SQL: Data Querying**
- Tuesday 27. 03. 2018: **05 - SQL: Advanced Constructs**
- Tuesday 03. 04. 2018: **06 - JPA** (Martin Řimnáč): Part 1, Part 2, Part 3
- Tuesday 10. 04. 2018: **07 - Relational Algebra**
- Tuesday 17. 04. 2018: **08 - Functional Dependencies**
- Tuesday 24. 04. 2018: **09 - Database Transactions**
- Tuesday 01. 05. 2018: *Canceled*
- Tuesday 08. 05. 2018: *Canceled*
- Tuesday 15. 05. 2018: **10 - Physical Layer**
- Thursday 17. 05. 2018: **11 - Database Applications**
- Tuesday 22. 05. 2018: **12 - Modern Trends**

Practical Classes

- 01 and 02 - **Conceptual Modeling**: exercises, solutions
- 03 - **Conceptual Modeling**: exercises
- 04 - **Relational Model**: exercises, solutions
- 05 - **SQL: Data Definition**: exercises, solutions
- 06 and 07 - **SQL: Data Querying**: exercises, solutions
- 08 - **SQL: Advanced Constructs**
- 09 - **Relational Algebra**
- 10 - **JDBC, JPA**
- 11 and 12 - **Functional Dependencies**

Timetable

	Jana Ahmad 111	Martin Svoboda 101+102+103+104	R. Černoch, G. Šourek 109+110	Martin Řimnáč 105+106+107+108
01 - **Conceptual Modeling**	Tuesday 20. 2.	Tuesday 20. 2.	Wednesday 21. 2.	Thursday 22. 2.
02 - **Conceptual Modeling**	Tuesday 27. 2.	Tuesday 27. 2.	Wednesday 28. 2.	Thursday 1. 3.
03 - **Conceptual Modeling**	Tuesday 6. 3.	Tuesday 6. 3.	Wednesday 7. 3.	Thursday 8. 3.
04 - **Relational Model**	Tuesday 13. 3.	Tuesday 13. 3.	Wednesday 14. 3.	Thursday 15. 3.
05 - **SQL: Data Definition**	Tuesday 20. 3.	Tuesday 20. 3.	Wednesday 21. 3.	Thursday 22. 3.
06 - **SQL: Data Querying**	Tuesday 27. 3.	Tuesday 27. 3.	Wednesday 28. 3.	Thursday 29. 3.
07 - **SQL: Data Querying**	Tuesday 3. 4.	Tuesday 3. 4.	Wednesday 4. 4.	Thursday 5. 4.
08 - **SQL: Advanced Constructs**	Tuesday 10. 4.	Tuesday 10. 4.	Wednesday 11. 4.	Thursday 12. 4.
09 - **Relational Algebra**	Tuesday 17. 4.	Tuesday 17. 4.	Wednesday 18. 4.	Thursday 19. 4.
10 - **JDBC, JPA**	Tuesday 24. 4.	Tuesday 24. 4.	Wednesday 25. 4.	Thursday 26. 4.
11 - **Functional Dependencies**	Tuesday 15. 5.	Tuesday 15. 5.	Wednesday 2. 5.	Thursday 3. 5.
12 - **Functional Dependencies**	Thursday 17. 5.	Thursday 17. 5.	Wednesday 9. 5.	Thursday 10. 5.
13 - Presentations	Tuesday 22. 5.	Tuesday 22. 5.	Wednesday 23. 5.	Thursday 24. 5.

Formal Requirements

- **Attendance** during practical classes is not compulsory, yet warmly **recommended**
- Altogether **7 individual homework assignments** will take place during the semester
- Everyone must **choose** their **distinct topic**, not later than at the second practical class
- This topic must be reported to and explicitly accepted by the tutor in advance
- Possible topics could be: library, cinema, cookbook, university, flights, etc.
- See the list below for additional suitable topics, feel free to choose your own topic
- Your homework solutions must be **within the topic, original, realistic, and non-trivial**
- Solutions can only be submitted via **BRUTE system** at https://cw.felk.cvut.cz/brute/
- **At most 140 points** in total can be gained **for all the homework assignments**
- Solutions are awarded by **up to 25, 20 or 15 points** respectively, depending on the assignment
- In case of any shortcomings, fewer points will be awarded appropriately
- Solutions can be submitted even repeatedly, only **the latest version is assessed**
- Once a given assignment is assessed by the tutor, it cannot be resubmitted once again
- **Delay** of one whole day **is penalized** by 5 points, shorter delays are penalized proportionally
- Should the delay be even longer, the penalty stays the same and does not further increase
- All the homework assignments must be submitted before the first enrolled exam date
- During some of the practical classes, **extra activity points** can be acquired, too
- **At least 100 points** is required for the **course credit** to be granted
- One fourth of all the points above this boundary is transferred as **bonus points** to the exam
- Only students with a course credit already acquired can sign up for the final exam
- The **final exam** consists of a compulsory written test and an optional oral examination
- **At most 100 points** can be acquired from the actual final **written test**
- The **final score** corresponds to the **sum of the written test and bonus points**, if any
- Based on the result, everyone can voluntarily choose to undergo an **oral examination**
- In such a case, the final score is further adjusted by **up to minus 10 to plus 5 points**
- Final grade: **90 points and more for A, 80+ for B, 70+ for C, 60+ for D, and 50+ for E**

Homework Assignments

- Preliminaries:
  - Homework solutions can only be submitted via BRUTE system at https://cw.felk.cvut.cz/brute/
  - Respect the prescribed names of individual files to be submitted (case sensitive, including extensions)
  - Place all the files in the root directory of your submission (when submitting archives)
  - Do not include shared libraries or any other files that are not explicitely requested

1: Conceptual Schema

- Points: **20**
- Assignment:
  - **Create a diagram of an ER conceptual schema** of your individual topic
  - It must contain all the following constructs:
    - At least 5 **entity types**
    - **Attributes** of all kinds (ordinary, structured, multivalued)
    - **Identifiers**
    - At least 5 **relationship types** with **cardinalities** specified, each used at least once (*1..1*, *0..1*, *0..N*, *1..N*)
    - **Recursive relationship type**
    - **Ternary** (or even more complicated) **relationship type**
    - **ISA hierarchy** with constraints specified (*complete*/*partial*, *exclusive*/*overlapping*)
    - **Weak entity type**
  - **Provide a textual description of your individual topic** in a natural language
- Requirements:
  - Each entity type must have at least one identifier
  - You may not use artificial identifiers (e.g. automatically generated integer ids) unless necessary
- Software:
  - **Creately.com** - Entity Relationship Diagrams
  - **Draw.io** - Blank Diagram, Entity Relation Shapes
- Conventions:
  - Relationship type cardinalities *1..1* may be omitted
  - Underline identifiers
- Submission:
  - **/er-diagram.pdf**: PDF file with an exported diagram of your ER schema
  - **/er-description.pdf**: text file with a description of your individual topic
- Deadlines:
  - **Group 111** - Jana Ahmad: **Monday 12. 3. 2018** until 23:59
  - **Groups 101, 102, 103 and 104** - Martin Svoboda: **Monday 12. 3. 2018** until 23:59
  - **Groups 109 and 110** - Radomír Černoch, Gustav Šourek: **Tuesday 13. 3. 2018** until 23:59
  - **Groups 105, 106, 107 and 108** - Martin Řimnáč: **Wednesday 14. 3. 2018** until 23:59

2: Relational Schema

- Points: **20**
- Assignment:
  - **Transform your ER diagram into the relational model schema**
    - I.e. transform all the involved entity types, relationship types, attributes as well as identifiers
    - Describe all foreign keys
  - **Draw a diagram of the transformed relational schema**
- Requirements:
  - Use a textual syntax described in the lecture as well as draw a visual diagram
  - **Both the schema and diagram must mutually correspond to each other as well as to the original ER diagram**
  - You must not introduce new artificial identifiers (e.g. automatically generated integer ids)
  - You may modify your ER schema (from the previous assignment) if necessary
  - You must extend and/or correct your ER schema in case it did not contain all the required constructs
- Conventions:
  - *Table(Key1, Atribute1, Atribute2, ...)*
  - Underline keys (distinguish between structured keys and multiple individual keys)
  - Describe foreign keys explicitly
- Software:
  - **DBDesignerFork** - Display / Notation / EER [1,n]
- Submission:
  - **/er-diagram.pdf**: PDF file with a diagram of the original ER schema (possibly altered, will not be assessed)
  - **/rm-schema.pdf**: Relational schema described using the textual notation
  - **/rm-diagram.pdf**: PDF file with a diagram of your relational schema
- Deadlines:
  - **Group 111** - Jana Ahmad: **Monday 19. 3. 2018** until 23:59
  - **Groups 101, 102, 103 and 104** - Martin Svoboda: **Monday 19. 3. 2018** until 23:59
  - **Groups 109 and 110** - Radomír Černoch, Gustav Šourek: **Tuesday 20. 3. 2018** until 23:59
  - **Groups 105, 106, 107 and 108** - Martin Řimnáč: **Wednesday 21. 3. 2018** until 23:59

3: SQL: Data Definition

- Points: **20**
- Assignment:
  - **Transform your relational schema into the corresponding SQL schema**
    - I.e. use *CREATE TABLE* statements to create a schema of your relational database
  - Satisfy all the following requirements:
    - Use appropriate **data types**
    - Ensure **referential integrity** including meaningful **referential actions**
    - Use each of the following integrity **constraints** at least once: *NOT NULL*, *PRIMARY KEY*, *UNIQUE*, *CHECK*
    - At least one constraint must be defined as a **column-level constraint** and one **table-level constraint**
- Requirements:
  - Your SQL script must be **syntactically correct and executable** without errors, even repeatedly
  - Use *DROP TABLE IF EXISTS* statements at the beginning of the script to **drop all the tables first**
  - Do not use tools to generate your SQL statements automatically, write them on your own
  - You are encouraged to introduce new artificial primary keys (e.g. integer ids) whenever appropriate
  - You may modify your relational model schema (from the previous assignment) if necessary
  - You must extend and/or correct your relational schema in case it did not contain all the required constructs
- Software:
  - **pgAdmin4**
- Server:
  - Host: *slon.felk.cvut.cz*, port: *5432*, initial password sent by e-mail
  - Password modification: ALTER ROLE db18_*login* WITH PASSWORD '*password*';
- Submission:
  - **/rm-schema.pdf**: Relational schema described using the textual notation (possibly altered, will not be assessed)
  - **/sql-schema.sql**: SQL script with a definition of your database schema
- Deadlines:
  - **Group 111** - Jana Ahmad: **Monday 26. 3. 2018** until 23:59
  - **Groups 101, 102, 103 and 104** - Martin Svoboda: **Monday 26. 3. 2018** until 23:59
  - **Groups 109 and 110** - Radomír Černoch, Gustav Šourek: **Tuesday 27. 3. 2018** until 23:59
  - **Groups 105, 106, 107 and 108** - Martin Řimnáč: **Wednesday 28. 3. 2018** until 23:59

4: SQL: Data Querying

- Points: **20**
- Assignment:
  - **Express at least 5 non-trivial queries in SQL** within your database
  - Use at least once each of the following constructs:
    - **Natural join**, generic **inner join**, as well as **outer join**
    - **Grouping and aggregation** (both *GROUP BY* and *HAVING* clauses)
    - One **set operation**: *UNION*, *INTERSECT* or *EXCEPT*
    - **Sorting** (*ORDER BY* clause)
    - **Sub-query** expression
- Requirements:
  - **Add comments describing the intended meaning of your queries in a natural language**
  - All query expressions must yield different queries, i.e. they cannot be just different expressions for the same query
  - Your SQL script must be **syntactically correct and executable** without errors, even repeatedly
  - You may modify your database schema (from the previous assignment) if necessary
  - You must extend and/or correct your database schema in case it did not contain all the required constructs
- Submission:
  - **/sql-schema.sql**: SQL script with the definition of your database schema (possibly altered, will not be assessed)
  - **/sql-queries.sql**: SQL script with your query expressions
- Deadlines:
  - **Group 111** - Jana Ahmad: **Monday 9. 4. 2018** until 23:59
  - **Groups 101, 102, 103 and 104** - Martin Svoboda: **Monday 9. 4. 2018** until 23:59
  - **Groups 109 and 110** - Radomír Černoch, Gustav Šourek: **Tuesday 10. 4. 2018** until 23:59
  - **Groups 105, 106, 107 and 108** - Martin Řimnáč: **Wednesday 11. 4. 2018** until 23:59

5: SQL: Advanced Constructs

- Points: **15**
- Assignment:
  - Create a **view**
    - Define a suitable view updateability level
  - Create an **index**
  - Create a **function**
    - Execute at least 1 *SELECT* and at least 1 *INSERT*, *UPDATE* or *DELETE* statement inside this function
  - Create a **trigger**
    - Do not use the previous function, implement a new one for the purpose of this trigger
- Requirements:
  - **Add comments describing the intended meaning of your database objects in a natural language**
  - Your SQL script must be **syntactically correct and executable** without errors, even repeatedly
  - Use *DROP VIEW | INDEX | FUNCTION | TRIGGER IF EXISTS* statements at the beginning of the script to **drop all the objects first**
  - You may modify your database schema (from the third assignment) if necessary
- Submission:
  - **/sql-schema.sql**: SQL script with the definition of your database schema (possibly altered, will not be assessed)
  - **/sql-script.sql**: SQL script with your advanced constructs
- Deadlines:
  - **Group 111** - Jana Ahmad: **Monday 16. 4. 2018** until 23:59
  - **Groups 101, 102, 103 and 104** - Martin Svoboda: **Monday 16. 4. 2018** until 23:59
  - **Groups 109 and 110** - Radomír Černoch, Gustav Šourek: **Tuesday 17. 4. 2018** until 23:59
  - **Groups 105, 106, 107 and 108** - Martin Řimnáč: **Wednesday 18. 4. 2018** until 23:59

6: Relational Algebra

- Points: **20**
- Assignment:
  - **Express at least 5 non-trivial queries in relational algebra** within your database
  - Use at least once each of the following constructs:
    - **Selection**, **projection** as well as **attribute renaming**
    - **Natural join**, **theta join**, **Cartesian product**, as well as **outer join**
    - **Set operation**: union, intersection or minus
    - **Division**
- Requirements:
  - **Add comments describing the intended meaning of your queries in a natural language**
  - All query expressions must yield different queries, i.e. they cannot be just different expressions for the same query
  - You may modify your relational model schema (from the second assignment) if necessary
  - You must extend and/or correct your relational schema in case it did not contain all the required constructs
- Submission:
  - **/rm-schema.pdf**: Relational schema described using the textual notation (possibly altered, will not be assessed)
  - **/ra-queries.pdf**: Expressions of your queries in relational algebra
- Deadlines:
  - **Group 111** - Jana Ahmad: **Monday 23. 4. 2018** until 23:59
  - **Groups 101, 102, 103 and 104** - Martin Svoboda: **Monday 23. 4. 2018** until 23:59
  - **Groups 109 and 110** - Radomír Černoch, Gustav Šourek: **Tuesday 24. 4. 2018** until 23:59
  - **Groups 105, 106, 107 and 108** - Martin Řimnáč: **Wednesday 25. 4. 2018** until 23:59

7: Database Application

- Points: **25**
- Assignment:
  - **Implement a simple desktop application in Java with JPA access to the database**
  - Create and annotate at least **2 entities and 1 relationship** in between them
    - Cardinality of this relationship must be *@ManyToMany*
  - Allow for a **complex processing of 1 of the selected entities**
    - I.e. implement all the following CRUD use cases...
    - *CREATE*: insertion of a new entity instance
    - *READ*: browsing of a list of all entity instances
    - *UPDATE*: modification of attributes of an existing entity instance
    - *DELETE*: removal of an existing entity instance
  - Allow for a **complex processing of the selected relationship**
    - I.e. implement all the following CRUD use cases...
    - *CREATE*: insertion of a new relationship instance by choosing both the involved entity instances
    - *READ*: browsing of a list of all related entity instances for a given entity instance
    - *DELETE*: removal of an existing relationship instance
- Requirements:
  - Your application must have a **graphical user interface** (e.g. using *Swing*)
  - Use must connect to our server at *slon.felk.cvut.cz* and only use your assigned database
  - It is insufficient to use just *JDBC* and not *JPA*
  - You may modify your database schema (from the third assignment) if necessary
  - Fill all the involved tables with **sample realistic data** (not necessarily from your application)
  - **Comment your source files**
- Software:
  - **NetBeans IDE**
  - **IntelliJ IDEA**
- Submission:
  - Whole NetBeans / Idea project with all source files
  - Executable application
- Deadlines:
  - **Group 111** - Jana Ahmad: **Monday 21. 5. 2018** until 23:59
  - **Groups 101, 102, 103 and 104** - Martin Svoboda: **Monday 21. 5. 2018** until 23:59
  - **Groups 109 and 110** - Radomír Černoch, Gustav Šourek: **Tuesday 22. 5. 2018** until 23:59
  - **Groups 105, 106, 107 and 108** - Martin Řimnáč: **Wednesday 23. 5. 2018** until 23:59
- Presentation:
  - There will be compulsory presentations during the very last practical class

Individual Topics

- Try to propose your own original topic in the first place
- You can also get inspired by the following topics (in alphabetical order)
  - Adresní místa, Armáda, Autobusové nádraží, Autosalon, Autoškola, Banka, Bankovní účet, Bazar, Bezpečnostní agentura, Blog, Botanická zahrada, Burza, Catering, Cestovní agentura, Cestovní kancelář, Cukrárna, Cvičiště pro psy, Čajovna, Čerpací stanice, Dálniční poplatky, Darování zážitků, Deskové hry, Diskuzní fórum, Divadelní hry, Divadlo, Dodávka vody, Docházkový systém, Dopravní dispečink, Dopravní nehody, Dopravní podnik, Dopravní uzavírky, Doručování zásilek, Dotační programy, Elektronická evidence tržeb, Elektronické recepty, Evidence smluv, Evidence součástek, Evidence zaměstnanců, Exekuce, Farmářské trhy, Filmy, Finanční poradenství, Finanční trhy, Finanční úřad, Fitness centrum, Fotbalová liga, Fotbalový tým, Fotoalbum, Galerie, Golfové kluby, Grantová agentura, Hobby market, Hodinový manžel, Hokejová liga, Horská služba, Hotel, Hrady a zámky, Hudební festival, Hudební nástroje, Hudební produkce, Jaderná elektrárna, Jazyková škola, Jazykové pobyty, Jednání zastupitelstva, Jeskyně, Jídelníček, Jízdenky na autobus, Jízdní řády, Kadeřnický salon, Kamionová doprava, Kasino, Katastr nemovitostí, Kavárna, Kino, Kniha jízd, Knihkupectví, Knihovna, Konference, Kravín, Kuchařka, Kurýrní služba, Kurzy vaření, Lékárna, Léky, Lesní školka, Letecká společnost, Letecká záchranná služba, Letiště, Letní tábor, Logistická firma, Logistické centrum, Logistický sklad, Lyžařská škola, Lyžařský areál, Mateřská škola, Menzy, Městská hromadná doprava, Mobilní operátor, Mobilní telefony, Modely vláčků, Multifunkční aréna, Muniční sklad, Muzeum, Mýtné brány, Nabídky dovolené, Nabídky práce, Nadnárodní společnost, Národní park, Nebankovní půjčky, Nemocnice, Nutriční hodnoty, Obchodní centrum, Obchodní rejstřík, Očkování do ciziny, Odevzdávání úkolů, Online cvičení, Online půjčovna seriálů, Ordinace lékaře, Orientační běh, Osobní doklady, Osobní trenér, Parkoviště, Pekařství, Personální agentura, Pěstounská péče, Pizzerie, Plánovací kalendář, Plánování termínů schůzek, Platební karty, Plavecký bazén, Počítačové hry, Pohádky, Pojišťovna, Policejní databáze, Politické strany, Populární hudba, Porodnice, Poslanecká sněmovna, Pošta, Požární ochrana, Pracovní úřad, Prodej výtvarných děl, Provoz metra, Průmyslová zóna, Předpověď počasí, Přepravní kontrola, Přírodní rezervace, Přístupový systém, Psychiatrická léčebna, Půjčování kol po městě, Půjčovna auta, Půjčovna lodí, Půjčovna svatebních šatů, Realitní agentura, Redakční systém, Registr obyvatel, Regulační poplatky, Restaurace, Rezervace letenek, Rezervace místností, Rezervace ubytování, Rezervace v restauraci, Rozvodná síť, Rozvoz jídla, Řízení letecké dopravy, Řízení projektů, Sázková kancelář, Sbírka zákonů, Sdílené cestování, Síť bankomatů, Síť multikin, Skautské středisko, Sklad nápojů, Sklárna, Sociální dávky, Sociální síť, Soudní řízení, Spediční firma, Společenství vlastníků jednotek, Sportovní klub, Sportovní turnaj, Správa hřbitova, Správa objektů, Správce financí, Srovnávač elektrospotřebičů, Srovnávač ubytování, Státy světa, Stavebnice lego, Střední škola, Studijní materiály, Studijní systém, Supermarket, Světové dědictví, Svoz a likvidace odpadů, Symfonický orchestr, Taneční škola, Taxi služba, Televizní program, Televizní seriály, Turistické cesty, Turistický oddíl, Turistický ruch, Ubytování v soukromí, Uprchlický tábor, Válečné konflikty, Včelař, Vědecké projekty, Vědecké publikace, Velkochov drůbeže, Velkoobchod, Veřejná zeleň, Veřejné zakázky, Vesmír, Vězení, Videopůjčovna, Virtuální prohlídky, Víza, Vlakové nádraží, Vojenský prostor, Volby, Volnočasové kurzy, Vozový park, Vydavatelství novin, Výkaz práce, Výrobní procesy, Vysokoškolská kolej, Výstaviště, Vývoj softwaru, Vzdělávací instituce, Webhosting, Webový obchod, Zábavní centrum, Zahrádkářská kolonie, Zahradnictví, Zastavárna, Zbraně, Zdravotní pojišťovna, Zdravotní úhrady, Zemědělská výroba, Zimní úklid komunikací, Zoologická zahrada, Zpravodajská služba, Žákovská knížka, Železniční síť
- Nevertheless, the following topics are **not allowed** this semester
  - Student information system

Recommended Literature

- Pokorný J. - Valenta M.: **Databázové systémy**.
  ISBN: 978-80-01-05212-9.
  Nakladatelství ČVUT, Praha, 2013.