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| <b>Module</b>                            | <b>Databases and Data Architecture Systems</b>  |
| <b>Code</b>                              | MSLS_V5_4   |
| <b>Degree Program</b>                    | Master of Science in Life Sciences (MSLS)   |
| <b>ECTS Credits</b>                      | 5   |
| <b>Workload</b>                          | 150h: 75h Lectures and Exercises, 75h Self-Study  |
| <b>Module Coordinator</b>                | <p><b>Name</b> Dr. Robert Vorburger</p> <p><b>Phone</b> +41 (0)58 934 57 44</p> <p><b>Email</b> robert.vorburger@zhaw.ch</p> <p><b>Address</b> ZHAW Zurich University of Applied Sciences<br/>Life Sciences and Facility Management<br/>Schloss 1<br/>8820 Wädenswil</p>  |
| <b>Lecturers</b>                         | <ul style="list-style-type: none"> <li>• Dr. Robert Vorburger</li> </ul>  |
| <b>Entry Requirements</b>                | <p>The course requires basic knowledge in the following topics:</p> <ul style="list-style-type: none"> <li>• Programming in Python</li> <li>• Statistical programming in R</li> </ul> <p>The scripting language Python as well as the statistical computing environment R are used in this module to create and process relational databases using SQL (structured query language). Prior knowledge of SQL is not required.</p>   |
| <b>Learning Outcomes and Competences</b> | <p>Yes, it is true: <i>Data Scientist</i> is the sexiest job of the 21<sup>st</sup> century (at least according to the Harvard Business Review). While knowledge is usually engineered using statistical methods, the basis is always a well-structured set of data. The module covers the techniques and structures used to efficiently store, process, and load data in databases.</p> <p>By completing the module, students will specifically acquire knowledge and skills in the following fields:</p> <ul style="list-style-type: none"> <li>• Terminology and general basics of databases and data architecture systems</li> <li>• Different types of databases and their concepts</li> <li>• Relational databases and SQL</li> <li>• Python/R and SQL</li> <li>• Data Warehouses</li> <li>• NoSQL database concepts</li> <li>• Graph-based databases</li> </ul> <p>Hands-on exercises and examples will strengthen the student's competences in applying database concepts in the fields of life sciences.</p> |
| <b>Module Content</b>                    | <p>The module basically consists of four parts:</p> <ul style="list-style-type: none"> <li>• <i>Part I - Data and Data Architecture</i> <ul style="list-style-type: none"> <li>○ What is data?</li> <li>○ How is data stored and processed?</li> </ul> </li> </ul>  |

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|                                       | <ul style="list-style-type: none"> <li>○ Databases vs file systems</li> <li>○ Database-Management-Systems</li> <li>○ Different types of databases: <ul style="list-style-type: none"> <li>▪ hierarchical</li> <li>▪ network-oriented</li> <li>▪ relational</li> <li>▪ object-oriented</li> </ul> </li> <li>● <i>Part II - Relational Databases</i> <ul style="list-style-type: none"> <li>○ Basic principles: entity integrity and referential integrity</li> <li>○ Entity-Relationship-Model</li> <li>○ What is ODBC?</li> <li>○ SQL (talk to the database)</li> <li>○ Python and SQL (hands-on in a life science scenario)</li> <li>○ R and SQL (hands-on in a life science scenario)</li> </ul> </li> <li>● <i>Part III - Data Warehouse</i> <ul style="list-style-type: none"> <li>○ Extract-Transform-Load</li> <li>○ OLAP-Cube</li> <li>○ Business Intelligence</li> </ul> </li> <li>● <i>Part IV - NoSQL</i> <ul style="list-style-type: none"> <li>○ Database types <ul style="list-style-type: none"> <li>▪ Key-Value-based</li> <li>▪ Document-based</li> <li>▪ Graph-based</li> </ul> </li> <li>○ SPARQL</li> </ul> </li> </ul> |
| <b>Teaching / Learning Methods</b>    | <ul style="list-style-type: none"> <li>● Lectures : ~40% classical teaching / ~30% guided exercises</li> <li>● Self-Study : ~20% exercises / ~10% literature studying</li> </ul>   |
| <b>Assessment of Learning Outcome</b> | <p>Programming assignments during the semester (20%)</p> <p>Final exam (written) (80%)</p>   |
| <b>Bibliography</b>                   | Important additional literature will be provided on Moodle.  |
| <b>Language</b>                       | English  |
| <b>Comments</b>                       | Data [ˈdeɪtə]: Borrowing from Latin <i>data</i> , nominative plural of <i>datum</i> (“that is given”), neuter past participle of <i>dō</i> (“I give”).   |
| <b>Last Update</b>                    | 17.09.2021   |