Assignment C01

a) Name three features of object-orientation as presented in the lecture. Moreover, for each of these features, name two common programming languages supporting this feature. (3 points)
b) Briefly describe the difference between static and dynamic typing. Moreover, name two statically typed programming languages as well as two dynamically typed languages. (3 points)
c) Briefly describe duck typing. (1 point)
d) Briefly describe reflection/meta-programming. (1 point)

Assignment C02

a) Name and briefly describe three parts of a language's eco system. (3 points)
b) What is a higher order function? (1 point)
c) What is a closure in the context of programming languages? (1 point)
d) Briefly describe the three alternatives for mapping inheritance to relational tables as presented in the lecture. (3 points)

Assignment C03

a) Briefly describe two benefits of object-relational mapping. (2 points)
b) Briefly describe JPA. (1 point)
c) Define of a JPA model class *User*. A user has an email address (the user's identifier, has to be a valid email address), a last name (mandatory), and a first name (optional). Use annotations if necessary (you can assume that there is an *Email* annotation). (3 points)
d) Name and briefly describe the two ways of materializing relationships with JPA/Hibernate. (2 points)

Assignment C04

a) Briefly describe the three components of the MVC architecture pattern as presented in the lecture. (3 points)
b) Name and briefly describe five benefits of Model-View separation in templates as presented in the lecture. (5 points)

Assignment C05

a) Briefly describe bottlenecks in the context of web application engineering as presented in the lecture. (1 point)
b) Briefly describe the three simple characteristics of scalable systems as presented in the lecture. (3 points)
c) Briefly describe vertical scaling as presented in the lecture. What is the problem with vertical scaling? (2 points)
d) Briefly describe horizontal scaling as presented in the lecture. What is a major issue with horizontal scaling? (2 points)

Assignment C06

a) Briefly describe cold, warm and hot spare components in the context of passive redundancy. (3 points)
b) What is the difference between active and passive redundancy? (1 point)
c) Name and briefly describe the two fundamental load balancing modes. (2 points)
d) What are the pros and contras of doing load balancing on hardware level? (2 points)

Assignment C07

a) Which three properties of data storages are mostly addressed by NoSQL databases? Moreover, name three of today's most prominent NoSQL databases. (3 points)
b) Briefly describe the CAP Theorem and eventual consistency. What is the meaning of the inconsistency window in this context? (3 points)
c) Name the four common categories of NoSQL databases as presented in the lecture. (2 points)

Assignment C08

a) Briefly describe the main idea of Key-Value Stores as presented in the lecture. Name two typical applications for this kind of NoSQL databases. (2 points)
b) What is the difference of Column Family Stores to Key-Value Stores? Name two strengths of Column Family Stores. (2 points)
c) What is the strength of Document Databases? Name two prominent examples for this kind of NoSQL databases. (2 points)
d) What means "index-free adjacency" in the context of Graph Databases? Name two typical applications for Graph Databases. (2 points)

Assignment C09

a) Briefly describe the two integration scenarios for web applications as presented in the lecture. (2 points)
b) What is a Web API? Name two typical formats used for data interchange. (2 points)
c) Name and briefly explain the three parts of a typical REST API specification as presented in the lecture. (3 points)
d) Briefly describe the REST API Maturity Model. (1 point)

Assignment C10

a) What is the difference between authentication and authorization? (1 point)
b) What is the motivation of the OpenID and the OAuth protocol? (1 point)
c) Briefly describe the three roles User, Relying Party (Service Provider), and Identity Provider which are involved in the OpenID authentication. How are these roles related to each other? (4 points)
d) What are request tokens and access tokens in the context of the OAuth protocol? (2 points)

Assignment C11

a) What is the major challenge of the HRS web application compared to common content management systems as presented in the guest lecture? (1 point)
b) Name four aspects you should know about your web application when aiming for performance optimization as presented in the guest lecture? (2 points)
c) Briefly describe synchronous and asynchronous transactions in the context of web applications. (1 point)
d) Name one HRS-related example where synchronous transaction is important, and one where it is supposedly not important as presented in the guest lecture. Briefly justify your answers. (4 points)

Assignment C12

a) Name and briefly describe issues of developing the UI manually instead of using an UI modelling approach as presented in the guest lecture? (3 points)
b) What are the three components in a UI modelling approach as presented in the guest lecture? Which one of them are technology-dependent, and which one not? (3 points)
c) What are the two basic kinds of elements in a view model as presented in the guest lecture? Give two examples for each of them. (2 points)