

# Data & Information – Test 1 (1.5 hours)

3 May 2019, 13:45–15:15

Program: Technical Computer Science / Business & IT

Module: Data & Information (201300180)

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Please note:

- Please answer every question on a different sheet of paper (the answers will be distributed to different persons for grading).
- You are not allowed to bring any study materials to the test; essential excerpts from the study materials are available as appendices. You do not need a calculator.

Grade = #points/10

## Question 1 (Requirements) (30 points)

The mission of the Town Public Library is to make culture and literature available for everyone. The presentation of the Library's collection has recently been rearranged so as to make it easier for visitors to find something that interests them. Care has been taken to make the building and the collection accessible for persons with various disabilities. As a next step, the Library wants to automate the process of lending books. When the staff need to spend less time on this, they have more time to help visitors finding something they like.

The current process to get a book from the library is as follows: you bring it to the counter, where the librarian scans your membership pass, scans the book's bar code, and removes the magnetic protection from the book.

This can be replaced by self-service machines. The visitor scans his/her pass, places the book in a proper position so that the magnetic protection will be removed when s/he scans the book's bar code. Visitors who require help with this can ask the Library staff, of course.

The self-service machines should obviously comply with legal standards regarding safety and data protection and suit the Library's objectives.

- Select the three quality characteristics that you consider most important for the self-service machines. Explain your choice. Please choose from the 31 quality characteristics (*regular font in Appendix A*), not from the 8 higher-level categories (*boldface in Appendix A*).
- For each of these quality characteristics, give an example of a meaningful quality requirement (*it does not have to be factually correct, but it should show what a requirement for that quality characteristic could look like*).

See Appendix A for a complete list of quality characteristics according to ISO/EIC Standard 25010.

## Question 2 (Database queries ) (40 points)

Below is the database schema for the Town Public Library.

Please note:

- Membership of the Library is per household, rather than per person. That means: if someone is a member, other persons living at the same address can get a membership pass for free.  
Thus address is an attribute of the (paying) member, name is an attribute of the membership pass.
- For popular books, the Library owns multiple copies of the same book title.
- Each time someone borrows a book, a new Loan is added to the database. Loans are not deleted after the book has been returned, but remain in the database.

Member	
mid	integer KEY
start_date	date
valid_until	date
address	text

Book_Title	
tid	integer KEY
title	text
aid	integer
year	integer

Membership_pass	
pass_no	integer KEY
mid	integer
name	text
birth_date	date

Book_Copy	
cid	integer KEY
barcode	text
tid	integer

Author	
aid	integer KEY
name	text

Loan	
lid	integer KEY
cid	integer
pass_no	integer
from	timestamp
until	timestamp

Write the following queries in SQL – please remove duplicates where needed.

Relevant parts of the SQL syntax are given in Appendix B.

- Give a list of authors and the number of loans (past and present) of books of these authors. Sort the list from highest to lowest number of loans and include only authors with at least 100 loans.
- Two persons are *co-members* if they share a membership, i.e., they live at the same address and have their own individual membership pass.  
Give the names and addresses of persons who have a co-member who never borrowed a book
- Give a list of author names and book titles for all books that were borrowed more than once by the same person.

### Question 3 (Web programming) (30 points)

- a) What is the role of an Application Server like Tomcat in the execution of a web application? How does this role relate to the Internet protocol stack, particularly HTTP?
- b) How can Tomcat know which Servlet to call once an HTTP request message arrives for a certain URL? For example, in the case of the BookQuote application discussed in lecture PROG1, how can Tomcat know that the URL path [bookQuote/bookQuote?isbn=1](#) refers to the `nl.utwente.di.BookQuote` class?
- c) What is the main drawback of using only Servlets (Java code) and simple index HTML pages (i.e., without JavaScript code) to implement web applications? Think of the BookQuote application example discussed during lecture WP 1. How is this drawback addressed by using JavaScript on the client-side?

## Appendix A: Quality characteristics (ISO/IEC 25010:2011)

<b>Functional suitability</b> <ul style="list-style-type: none"> <li>– Functional completeness</li> <li>– Functional correctness</li> <li>– Functional appropriateness</li> </ul>	<b>Reliability</b> <ul style="list-style-type: none"> <li>– Maturity</li> <li>– Availability</li> <li>– Fault tolerance</li> <li>– Recoverability</li> </ul>
<b>Performance efficiency</b> <ul style="list-style-type: none"> <li>– Time behavior</li> <li>– Resource utilization</li> <li>– Capacity</li> </ul>	<b>Security</b> <ul style="list-style-type: none"> <li>– Confidentiality</li> <li>– Integrity</li> <li>– Non-repudiation</li> <li>– Accountability</li> <li>– Authenticity</li> </ul>
<b>Compatibility</b> <ul style="list-style-type: none"> <li>– Co-existence</li> <li>– Interoperability</li> </ul>	<b>Maintainability</b> <ul style="list-style-type: none"> <li>– Modularity</li> <li>– Reusability</li> <li>– Analysability</li> <li>– Modifyability</li> <li>– Testability</li> </ul>
<b>Usability</b> <ul style="list-style-type: none"> <li>– Appropriateness recognizability</li> <li>– Learnability</li> <li>– Operability</li> <li>– User error protection</li> <li>– User interface aesthetics</li> <li>– Accessibility</li> </ul>	<b>Portability</b> <ul style="list-style-type: none"> <li>– Adaptability</li> <li>– Installability</li> <li>– Replaceability</li> </ul>

## Appendix B: Excerpts from SQL syntax

(choice is indicated by “|”, optional inclusion by “[...]”)

select clause:

```
SELECT [ DISTINCT ] '*' | (aggregate) columns
FROM tables
[ WHERE condition ]
[ GROUP BY columns
  [ HAVING condition ] ]
[ ORDER BY columns [ DESC ] ] ;
```

condition:

```
boolean expression | [ NOT ] EXISTS ( select clause )
```

boolean expression:

```
column = value | boolean expression AND boolean expression
```