

Exam Software Architecture

December 2014

This exam is centered around the case study 'Customer Bonus System' (Cubos).

Cubos is provided as a service to retail shops. Shop owners use the Cubos system to generate QR-codes for products sold in their shop. The QR-codes are placed in the shop next to these products so that customers can scan the codes. When customers scan the QR-code with the Cubos-app on their smart phone, they participate in a lottery with a (low) chance to win a price reduction for that product. The reduction is a variable percentage of the product price, and may range between 0 and 5%. Customers may participate in as many lotteries as they want, but they cannot immediately rescan the same QR-code in an attempt to obtain a higher reduction. The Cubos system tracks which products the customer is interested in, i.e. which QR-codes the customer scans, so that customer profiles can be established. Based on the customer profiles, the customers receive direct marketing.

When customers win a price reduction, it is added to their personal Cubos account. At the cash register, customers present their personal Cubos card to the cashier. This card is tied to their account. When the cashier scans the Cubos card, any price reductions that apply to the current sale are immediately applied. To this end, the store's cash register system is connected to the Cubos system. Every price reduction that a customer has won may only be applied once, and only in the store in which the price reduction was won. When the reduction has been used, it is removed from the customer's Cubos account. Customers may use the Cubos app or visit the Cubos website to view their account details and the reductions that they still have available.

Note: this problem description may be ambiguous and incomplete. In answering the questions, you are free to complete it (if needed) and to briefly motivate your assumptions.

Question 1: Software Life Cycle and Architecture

Bass defines software architecture as "the set of structures needed to reason about the system, which comprise software elements, relations among them, and properties of both"

- a) List and describe the three categories of architectural structures.
- b) When is a structure 'architectural'?
- c) Concisely explain the Architecture Influence Cycle.

Question 2: Architecture representation

- a) Concisely explain the main characteristic difference between a component & connector view and a module view.
- b) Provide one viewpoint specification for the Cubos case study. Explain why and for whom that viewpoint is relevant.
- c) Give the architectural view of the Cubos system for the viewpoint you defined under b). Present adequate documentation of your view.

Question 3: Design

- a) Discuss the implications of bounded rationality on design decisions.
- b) Give five elements of design decisions that one needs to document. Motivate your choice.
- c) Concisely explain the Attribute-Driven Design method.

Question 4: Software quality

- a) List three typical problems with discussions of quality attributes
- b) Describe the parts of a quality attribute scenario
- c) Provide an example of an availability tactic relevant to the Cubos case study.
Explain why this tactic is relevant.
- d) Give an example of a concrete quality attribute scenario for the Cubos case study

Question 5: Architecture Analysis

- a. List and describe the outputs of the ATAM
- b. Give the definition of a 'sensitivity point'
- c. Concisely explain the notion of a 'utility tree', as used in ATAM

Scoring

With this exam, you can gain 90 points at most. Your final mark for the written exam is calculated as follows:

$$\text{Final mark} = (\text{\#points} + 10) / 10$$

The weight of each question is as follows:

1a: 3	b: 2	c: 5	= 10
2a: 5	b: 5	c: 10	= 20
3a: 5	b: 5	c: 10	= 20
4a: 4	b: 4	c: 6	d: 6
5a: 10	b: 5	c: 5	= 20