

Department of Computing and Communication Technologies
Oxford Brookes University
U08182: Information Systems Design
(Semester 2, 2013-2014)

Coursework Specification

Software Architectural Design and Evaluation

1 Background

This coursework is designed to develop and test your attainment of the following learning outcomes.

1.1 Knowledge, Understanding and Disciplinary Skills

i.	The knowledge of the information systems design, in particular the following aspects. a. The principles, methods and techniques for information systems design; b. The relationship between software architectural structures and their quality; c. The catalogue of software architectural styles and their quality features;
ii.	The skills of designing information systems in complex contexts, in particular, a. The use of appropriate techniques for software design; b. Modelling information systems' architectural structures in appropriate graphic notations; c. Selection of appropriate architectural styles and design of component features; d. Evaluation of the quality of software and information systems as designed; e. Documentation of information system design;
iii.	The awareness of personal responsibility for and professional codes of conduct and the ability to incorporate a critical ethical dimension into a major piece of work on information systems design

1.2 Intellectual Skills

i.	The skill to analyse design problems without guidance, using a range of techniques appropriate to the subject
ii.	The skill to transform design problems of information systems and constraints to novel design solutions with minimum guidance
iii.	The skill to critically evaluate and compare design solutions and assess their reliability, validity, modifiability and other quality attributes
iv.	The ability to apply appropriate knowledge and skills confidently and flexibly in dealing with complex design problems
v.	The skill of self management by acting autonomously with minimal supervision or direction within agreed guidelines, and collaboratively with peers

1.3 Transferable Skills

i.	The skill of group working in interacting effectively within a learning / professional group, recognising, supporting or being proactive in leadership, negotiating in a professional context and managing conflict
ii.	The skill of self evaluation in seeking and making use of feedback and reflecting on action, the application of own criteria of judgement and, when appropriate, challenging received opinion
iii.	The ability of being autonomy in taking responsibility for own work and criticising it
iv.	The skill of communications in engaging effectively in debate in a professional manner and producing detailed and coherent project reports
v.	The ability of problem solving in dealing with complex problems and the application of appropriate knowledge, tools and methods to their solution

2 The problem to be solved

A petrol filling station has a number of pumps, each of which can be used to dispense both diesel fuel and unleaded petrol. There is a small local computer in each pump that displays the type of fuel taken by a customer,

and the volume of fuel taken by a customer from the pump, and calculates and displays the total amount of money the customer needs to pay. When the customer returns the pump nozzle to its socket, this computer sends a record to the cashiers' consoles containing the details of the current transaction, which include the following data:

- Pump identity;
- Type of fuel;
- Volume of fuel;
- The total amount of money to be paid.

Each console is a computer system with a display screen, an input keyboard, a credit card reader and a receipt printer. There may be a number of cashiers; each has its own console. A customer can go to any of the cashiers to pay for the fuel. Once a customer paid, the record should be recorded in the system.

You are required to design a software system running on the computers of the pumps and the cashier's consoles to process the transactions.

(Note: You may optionally use a server computer in addition to the computers associated to the pumps and consoles.)

3 Tasks to do

In this coursework, you are required to work in a group of **4 or 5** students to make **4 or 5** designs of a software system in different architectural styles according to the above specification of the problem, and to evaluate the designs.

You must perform the following tasks in order to complete the coursework. The distribution of their weights in the assessment is also given below.

3.1 Part 1: Design (50 marks)

(1) Analysis of design problem (10 Marks)

The specification of the design problem should be examined and analysed for the following two purposes:

- (a) to discover hidden constraints that are implicitly imposed or implied by the specification;
- (b) to identify quality requirements of the software system.

In the design documentation, you should include a section on design problem definition, covering the functional requirements, and quality requirements and the constraints.

(2) Designs of a software system in different architectural styles (40 marks)

Each group is required to complete **four** or **five** architectural designs in different software architectural styles. **Each group member is required to be responsible for the design in one style. Each design weights 10 or 8 marks (depending on the number of members in the group).** The design documentation should contain one section for each design solution. For each design solution, the following aspects should be presented at an appropriate level of abstraction.

- ◆ **Rationale:** Explain the ideas of the design and the rationales in the selection of the architectural style;
- ◆ **Structure:** Present the architecture of the designed system in the form of a diagram in the Software Architecture Visual Notation;
- ◆ **Components:** Describe the functions and key features of the components of the system;
- ◆ **Connectors:** Describe the features and interface of connectors and the interactions through the connectors between the components.

3.2 Part 2: Evaluation (30 marks)

According to the functional and non-functional requirements, the designs made in part 1 should be evaluated and compared by applying a scenario-based architectural analysis and evaluation technique. This means that following activities should be performed and documented.

(1) Translation of quality concerns into assessment scenario (20 marks)

The quality requirements identified in part 1 should be translated into a set of scenarios applicable to the assessment of the designs and assigned with appropriate weights to represent their importance.

(2) Assess and compare designs on their modifiability (10 marks)

The designs should be assessed against the scenarios that represent **modifiability** requirements by applying the SAAM method. **Each member of the group should be responsible for assessing one design.**

The set of designs should be compared by systematically applying a metric of software design with the weights assigned to the scenarios, and the final conclusions are drawn accordingly.

(Note. You are only required to evaluate and compare the designs on their modifiability, rather than all quality requirements.)

3.3 Teamwork exercise (20 marks)

Teamwork exercises form an important part of the coursework. Each group must exercise teamwork in a professional manner. Each group must produce a report on the teamwork exercise and include the report in the coursework submission in a separate file. The teamwork report should include the following two parts.

(1) Team performance report (10 marks)

A general report on teamwork for the whole group should cover the following aspects:

- (a) A report on the **collaboration mechanism** of the group, which should describe and explain how the group worked together to achieve the group's common goals.
- (b) A summarisation of **who-did-what** in the form of a table.
- (c) The **documentation of group activities**. Group activities should be properly recorded and documented. All group meeting agendas and minutes should be attached to the report as an appendix.

(2) Individual's self-assessment of performance (10 marks)

Each member of the group should perform a self-assessment according to the following criteria:

- interacting professionally within the group, including engaging effectively in discussions and/or debating in a professional manner, negotiating in a professional context and managing conflict;
- recognising, supporting or being proactive in leadership;
- being autonomous in taking responsibility for own work and criticising it;
- seeking and making use of feedback on his/her own work, and reflecting on action, the application of own criteria of judgement and, when appropriate, challenging received opinion;
- contributing to the technical development of the project;
- producing detailed and coherent project reports;

Each member's self-assessment on each criterion must be presented in the form of a grade on each of the above criteria (grades: A+, A, B+, B, C, F, where F means "fail") and a statement that supports the grade of your self-assessment.

Each member's self-assessment must be *frank* and *honest*, and *based on facts*.

4 Submission of Coursework

4.1 When to submit

- Due Date: 1:00pm on Tuesday, Week 10 (1 April 2014).

4.2 What to be submitted

Each group must submit two word-processed documents included in one zip file for

- (a) A design document;
- (b) A teamwork exercise report.

4.3 Where to submit

You must upload the coursework online to Moodle.

Prof. Hong Zhu
Version 1: 31 Jan. 2014
Revised: 19 Feb. 2014.