

Specification of Coursework-1

An Exercise in Designing a Software-Based System: *From requirements through to design-level models*

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THIS IS AN INDIVIDUAL PROJECT

While discussion with fellow students as to the general nature of this project is acceptable, it is critically important that the solution you adopt and report are completely your own work. The re-use of other peoples work is not permitted and if identified will be treated as a disciplinary matter. Information on plagiarism can be found via

<https://www.hw.ac.uk/students/studies/examinations/plagiarism.htm>

1 Introduction

F28SD is assessed 100% by coursework. The coursework is divided into 2 parts, this document specifies what is required for the first part – Coursework-1.

2 The tasks involved in Coursework-1

You are required to develop a series of design models for a software-based access control system. The system is to be called *Secure Occupancy System* (SOS). The remit for SOS is described informally below:

SOS shall allow authorized individuals to access a building. Three categories of individual shall be recognized by SOS, i.e. i) an **essential staff** member, ii) a **non-essential staff** member and, iii) a **guest** (i.e. someone that is not a staff member). Operationally, SOS shall interact with three existing external software systems, i.e. i) the **Staff Records System** (SRS), ii) the **Archive Access System** (AAS) and, iii) the **Security Monitoring System** (SMS). SOS shall maintain a record of all individuals that access the building. For staff members it shall record their staff ID (SID) and the time at which they enter and exit the building. For guests it shall record their name, affiliation and the SID of the staff member that is hosting their visit. The times when a guest enters and exits the building should also be recorded respectively. All external access

points to a building shall be equipped with a keypad. All the keypads shall be connected only to SOS. These keypads support only two access modes, i.e. *staff-access* and *guest-access*. If staff-access mode is selected by an individual then a 4-digit SID is requested followed by a 4-digit PIN. Only when both the SID and PIN have been entered and validated is access to the building granted. In the case of guest-access mode, an 8-digit one-time-code (OTC) is requested. Access to the building is conditional on the 8-digit OTC being valid and the staff member hosting the guest already being in the building. SRS holds details of all staff members and guests, and can provide these details on demand, with the exception of the PIN information. For example, if X denotes a valid SID, then `retrieveCat(X)` returns the staff category associated with X , i.e. *essential* or *non-essential*. Crucially, SOS shall use SRS to validate the various access codes that it receives via the keypads. That is, when SOS supplies SRS with both a SID and PIN, SRS will respond to SOS by confirming whether or not the two codes are valid, i.e. SID is a valid staff ID and the PIN provided is correct with respect to the given SID. If SOS supplies instead an OTC, SRS will confirm if it is valid by returning the SID of the associated host. Non-essential staff shall not be allowed to enter a building before 08:00 each day while guests shall not be allowed to enter before 09:00. If any non-essential staff or guests are in the building at 22:00 then SOS shall generate a security alert, i.e. send a message to SMS. The message should contain the names of all the individuals that are no longer authorized to be in the building. If any individual enters or exits the building outside the core hours of 08:00-22:00 then SOS shall send a message to SMS naming the individual. At 23:59 each day the SOS archives its records of all individuals that have entered and/or exited the building during the previous 24-hours. This archive process shall involve SOS sending the appropriate records to AAS. Once AAS has acknowledged receiving the records, SOS shall delete its own copy.

Based upon this informal description, you are first required to define and model a set of requirements for SOS. Secondly, you are required to develop a set of design models that achieve your requirements. Thirdly, you are required to derive a set of test case scenarios using aspects of your design models. Specifically, you are required to undertake the following 9 tasks:

T1: State explicitly any assumptions that you have made about the capabilities required of SOS which have not been made explicit above. In addition, state explicitly any expectations you have made about the three external systems that SOS relies upon and which have not been made explicit above.

T2: Develop a set of functional and non-functional¹ requirements.

T3: Develop a Use Case model that includes base use cases for:

- individuals entering the building.
- individuals exiting the building.
- checking out of hours occupancy.
- archiving access records.

Your **Use Case** model should include a **single use case diagram** and **use case specifications** (textual descriptions) for all your base use cases – don't forget to specify **alternative flows**. Any auxiliary use case(s) that you choose to introduce should appear within the use case diagram and their specifications should also be defined.

¹Two non-functional requirements will be sufficient.

- T4:** Provide a **traceability matrix** that links all your use cases with your **functional requirements (T2 & T3)**.
- T5:** Develop a **single Class Diagram** for SOS. Note that your **Class Diagram** should show the dependencies between SOS and the three external systems. The boundary between SOS and the three external systems should be clearly defined.
- T6:** Develop **Sequence Diagram(s)** based upon your use case specification(s) for an individual entering the building (**T3**).
- T7:** Develop an **Activity Diagram** based upon your use case specification(s) for an individual entering the building (**T3**).
- T8:** Develop three **State Machine Diagrams**, where each diagram models access to the building by one of the three distinct categories of individual, i.e. essential staff, non-essential staff, guest.
- T9:** Derive a set of **scenario test cases** from your **Sequence Diagram(s) (T6)**. For background on **scenario test cases**, see the notes for the “*Software Verification: A Life-Cycle Perspective*” lecture (see Week 8 on Canvas).

You **should** use the specification templates (i.e. use case and extension use case templates) given on the Canvas course pages (see the “UML Related Material” module). UMLet is recommended for developing your UML diagrams, however, you may use an alternative drawing tool if you wish. But please note that hand-drawn UML diagrams are **not acceptable**.

3 The structure and content of your submission for Coursework-1

Your submission **should** take the form of a report (**pdf format**)². The front page **should** include:

- report title (including course code)
- date of submission
- your name
- your “Person Identification (Person ID)” (i.e. your H00XXXXXX code)
- your degree programme
- your campus of study

Your report **should** contain page and section numbers, as well as a table of contents. In addition to an introductory section outlining your submission, the report **should** be divided into 10 sections corresponding to the following 10 deliverables:

- D1:** Your **assumptions**. Each **assumption** should be numbered. **[T1] (8-marks)**
- D2:** Tables containing your **functional** and **non-functional** requirements, again using a clear numbering scheme. **[T2] (20-marks)**
- D3:** Your **Use Case** diagram for SOS. **[T3] (20-marks)**
- D4:** **Specifications** (textual descriptions) for the base use cases you have identified including any auxiliary use cases. **[T3] (20-marks)**

²Note that MS Word allows you to export a document as a pdf file.

- D5:** Your **traceability matrix**. [T4] (3-marks)
- D6:** Your **Class Diagram** for your SOS design. [T5] (20-marks)
- D7:** The **Sequence Diagram(s)** you derived from the use case specification(s) for an individual entering the building. [T6] (9-marks)
- D8:** The **Activity Diagram** you derived from the use case specification(s) for an individual entering the building. [T7] (9-marks)
- D9:** Your three **State Machine Diagrams** that model the three categories of individual that can access the building. [T8] (18-marks)
- D10:** The set of **test case scenarios** you derived from your **Sequence Diagram(s)**. [T9] (8-marks)

4 Submission deadline for Coursework-1

Coursework-1 counts for 80% of the overall mark for the course. Your report should be submitted via Canvas. **4-marks** will be allocated to the quality of your report. The submission link can be found within the “Assessment” link of the F28SD “Course Navigation” panel. The **deadline** for submitting **Coursework-1** is **Monday 7 March 2022 (week 9):**

3.30pm Edinburgh (local time)

11.59pm Malaysia (local time)

11.59pm Dubai (local time)

The standard penalty for the late submission of coursework will be applied unless evidence of Mitigating Circumstances is provided (see Undergraduate Programme Handbook for details).