Problem description

The formal specification techniques introduced in this course are expressive and applicable to many research fields. By applying those techniques, you can enhance the quality of design, especially in terms of precise description and formal verification of the software system under development. In this 15% assignment, you are required to use the Z and B formal modelling languages to specify the design of a software system and the associated tools to analyse the design. You could select one of the following systems or find your own system, collect the requirements and document its design.

- Online Shopping System

- Library Management System

- Email Client/Server System

- Multi-Lifts Control System

- Smart Home Security System

- Petrol Station Management System

- Police or Ambulance Dispatch System

- Travel Booking Management System

- Part 4 Project Management System

- Smart Building Control System

- Online Chatting System

- Air Traffic Control System

- Bus Management System

- Online Banking System

- Train Control System

You should specify your design model based on a real life scenario of such a system. That is to collect the functional requirements of your selected system based on their real world applications. The tasks required for this assignment and the associated marks are listed as follows.

1. Document the functional requirements of the system under design in a report form [10 marks];

2. Design a Z formal specification of the system under design, and simulate the design model using the ProB model checker [20 marks];

3. Extend the initial Z design model into a refined B specification model, and simulate/verify the design using the ProB tool [50 marks];

4. Document the B design model and its verification in a report form [20 marks]

This assignment could be worked on as a single person task or in a group of no more than two students.

Files to submit

- Submit a Z formal specification model in the Latex source format, so that it can be loaded and simulated using the ProB tool.

- Submit a B formal specification model that refines the initial Z design. The model should be in the format that is supported by either the ProB tool, so that necessary simulation and verification can be carried out.

- Submit a report in PDF format (not more than 5 pages, single spaced 11/12pt). The reports should focus on describing the system requirements, explaining the B model and discussing the properties can be verified, etc.

- If you are working in a group of two students on the assignment. You can submit the same Z/B specification, however, the report has to be individually written. Please provide the name of your assignment partner in your submission.

Assessment

The assignment will be assessed for 100 marks in total (= 15% of the final grade), which consists of:

- Z specification modeling (20 marks), i.e.,

  - concise and correctness (10 marks)
  - structure and simplicity (10 marks)

- B specification and system property modeling (50 marks), i.e.,

  - concise and correctness (15 marks)
  - complexity and completeness (20 marks)
  - structure and properties (15 marks)
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- Written report of the formal modeling and discussion (30 marks), i.e.,

  - clarity of the explanation (10 marks)
  - discussion and presentation (10 marks)
  - aspects refer to verification (10 marks)

The due date of assignment 1 is **26 August 2022, 5:00PM**.