



# Super fancy name for Advanced Software Modeling Assignment

Sarah Gosch

**BSc (Hons) Software Engineering**  
**School of Engineering and Computing**  
**University of Lancashire**

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# Introduction

Purpose: Briefly introduce the real-time temperature regulation unit being developed for smart laboratory equipment.

Scope: Mention that the report covers the formal specification, UML modeling, and concurrent design required to meet high-integrity safety standards.

# System Requirements and Decomposition

Functional Requirements: List the core operations, such as continuous monitoring of multiple sensors and activating cooling/heating components.

Non-Functional Requirements: Detail the constraints, including  $\pm 0.1^\circ\text{C}$  accuracy and the 1-second response time limit.

Subsystem Architecture: Describe the modular breakdown into SensorInput, Temperature-Controller, ActuatorControl, and SystemMonitoring.

Use Case Modeling: Present a UML use case diagram showing actors (e.g., Environment, System Operator) and their interactions.

# UML Structural and Behavioural Modelling

Class Diagram: Provide a structural view of the system's classes, their relationships, and multiplicities.

Formal Constraints (OCL): Document the Object Constraint Language (OCL) expressions for invariants, preconditions, and postconditions.

Dynamic Behaviour: Include sequence or activity diagrams to model the control loop and sensor reading process.

# Formal Specification and Design by Contract (DbC)

Contract Specification: Provide the formal JML (Java Modeling Language) or annotated Java code for the TemperatureController.

Verification Logic: Explain how Design by Contract (DbC) principles ensure correctness by preventing invalid states and software faults.

Testing Support: Discuss how these specifications assist in the verification and testing process.



# Concurrency and Real-Time Behaviour

Thread Management: Model the concurrent components, such as multiple sensor threads accessing shared data.

Synchronization Strategy: Identify potential race conditions or deadlocks and explain your use of mutexes, semaphores, or monitors to solve them.

Implementation: Provide Java code snippets demonstrating thread synchronization or real-time scheduling.

# Conclusion and Evaluation

Summary: Summarize how the formal models and specifications support the reliability and performance goals of the system.

Technique Evaluation: Briefly evaluate the software development techniques used (UML, OCL, JML, and Java concurrency) in terms of their effectiveness for high-integrity systems.

# References

# Appendix A - Tables & Figures

Column name	Description
<b>Title</b>	Title of Game
<b>Release Date</b>	Games first version release Date
<b>Team</b>	Developer Team
<b>Rating</b>	Average rating
<b>Times Listed</b>	Number of users who listed the game
<b>Number of Reviews</b>	Number of reviews received from the users
<b>Genres</b>	All genres connected with the game
<b>Summary</b>	Summary of the game provided by the team
<b>Reviews</b>	User reviews
<b>Plays</b>	Number of users that have played the game before
<b>Playing</b>	Number of current users who are playing the game
<b>Backlogs</b>	Number of users who have access but haven't started with the game yet
<b>Wishlist</b>	Number of users who wish to play the game

Table A.1: Detailed column description for 'Popular Video Games 1980–2023'

ID	Title	Release Date	Team	Rating	Times Listed	Reviews	Genres	Summary	Reviews	Plays	Playing	Backlogs	Wishlist
0	Elden Ring	25.02.2022	['Bandai Namco Entertainment', 'FromSoftware']	45	3.9K	3.9K	['Adventure', 'RPG']	Elden Ring is a fantasy, action and open world ...	['The first playthrough of elden ring is one ...	17K	3.8K	4.6K	4.8K
1	Hades	10.12.2019	['Supergiant Games']	43	2.9K	2.9K	['Adventure', 'Brawler', 'Indie', 'RPG']	A rogue-lite hack and slash dungeon crawler in ...	['convinced this is a roguelike for people who ...	21K	3.2K	6.3K	3.6K
2	The Legend of Zelda: Breath of the Wild	03.03.2017	['Nintendo', 'Nintendo EPD Production Group No. 3']	44	4.3K	4.3K	['Adventure', 'RPG']	The Legend of Zelda: Breath of the Wild is the first ...	['This game is the game (that is not CS:GO) that ...	30K	2.5K	5K	2.6K
3	Undertale	15.09.2015	['tobyfox', '8-4']	42	3.5K	3.5K	['Adventure', 'Indie', 'RPG', 'Turn Based Strategy']	A small child falls into the Underground, where ...	['soundtrack is tied for #1 with nier automata ...	28K	679	4.9K	1.8K
4	Hollow Knight	24.02.2017	['Team Cherry']	44	3K	3K	['Adventure', 'Indie', 'Platform']	A 2D metroidvania with an emphasis on close ...	['this games worldbuilding is incredible, with ...	21K	2.4K	8.3K	2.3K

Figure A.1: Games Data Head