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Department of Computer Science
University of Pretoria

COS750 - Educational Software Development

Assignment 3 and Exam

2 October 2025

1 Introduction

Design patterns form an integral part of the design phase of the software development lifecycle, specifically when designing for Object Orientation. It is therefore not strange for patterns to be included in the Computer Science curriculum specification – CS2023 [Kumar et al., 2024], specifically the *SE-Design: Software Design* Knowledge area.

You have been approached by the COS 214 – Software Modelling – lecturer at the University of Pretoria to help develop an "app" to augment the lectures for the classical design patterns [Gamma et al., 1995] taught during the module.

2 Instruction

Design and develop a prototype of the "app" (to be referred to as the *COS214 app*) for one of the design patterns discussed in Gamma et al. [1995]. The design and development of the prototype of the *COS214 app* will contribute to Assignment 3. A presentation of the rationale for the design of the *COS214 app* and a demo will contribute to the Examination for the module along with a self reflection component.

Assignment 3 and the presentation of the *COS214 app* will be completed in groups of 3 to 7 students. The self reflection component will be completed individually.

2.1 Assignment 3

For this assignment, you need to choose one of the design patterns from Gamma et al. [1995], and design and implement a prototype of the *COS214 app* for the chosen pattern. You may assume that the students who will be using your app have attended the lecture on the pattern prior to them using your app. The app should include some form of assessment that can be used to report on why a student requires an intervention for the specific design pattern or any C++ concepts not understood required for the pattern. The modules notes [Marshall and Pieterse, 2015], provide information on C++ knowledge required for the particular pattern.

Make use of a Software Engineering (SE) approach to design your *COS214 app*, and one of the Instructional Design (ID) approaches – refer to Section 3.1 – when designing the content for your app. Make sure you document both the SE and ID approaches in separate documents. These documents and the prototype will be used to calculate your mark for Assignment 3.

The ID documentation should further reflect on your instructional choices. Which learning theories are to be applied, the learning styles the app is going to cater for, how the app is going to keep the student motivated, assess the progress

of the student on the appropriate level *etc.* Effectively, applying everything you have learnt and will be learning in this module.

You may make use of Generative AI (GenAI) to help generate the content for your app. Please acknowledge that you made use of GenAI and include your prompt and the tool you used in your ID documentation .

2.2 Examination

The examination component will comprise of a presentation and demonstration (20%), and a self reflection (30%). Details of these will be presented closer to the time.

3 Resources

The resources listed below should help you to understand what Instructional Design is and provide an overview of Design Patterns.

3.1 Instructional Design

- Resources for understanding Instructional Design
  - What is Instructional Design? `https://www.youtube.com/watch?v=wXLijkLgSxk`
  - What is Instructional Design? `https://www.youtube.com/watch?v=w0iQgStGND4&t=94s`
  - Overview of Instructional Design Models. Focus is on ADDIE, mentions Dick and Carey, Pebble-in-the-Pond, and SAM. `https://www.youtube.com/watch?v=Buz-cFIB-c0`
  - Leaving tried-and-tested ADDIE for emerging SAM - An instructional design models' war of succession? `https://www.youtube.com/watch?v=v2Ucr1XKAXE`
  - Robert Gagne. `https://www.youtube.com/watch?v=FgDcUnObLqI`
  - Introduction to First Principles of Instruction book. `https://www.youtube.com/watch?v=OReU2n1RyqY&t=736s`
- Instructional Design Models by Educational Technologies
  - Instructional Design Models and Theories `https://educationaltechnology.net/instructional-design-models-and-theories/`
  - Dick and Carey Instructional Model `https://educationaltechnology.net/dick-and-carey-instructional-mode`
  - ADDIE Model: Instructional Design `https://educationaltechnology.net/the-addie-model-instructional-de`
  - Kemp Design Model `https://educationaltechnology.net/kemp-design-model/`
  - ASSURE: Instructional Design Model `https://educationaltechnology.net/assure-instructional-design-mod`

After working through the resources on ID, you should be able to answer the following questions on ID to make an informed choice of the best model for designing your prototype.

- What is instructional design?
- What does an instructional designer do?
- Why is instructional design important?
- Instructional design theories
- How do Gagne's principles of learning impact Instructional Design?
- What are Merrill's principles of instructional design?
- How do Merrill's principles differ from Gagne's?
- Models (or frameworks or methods or processes) for instructional design
- How do the Learning theories, Learning styles and motivation link to Instructional Design?
- Are SE and ID so different?

3.2 Design Patterns

Other than Gamma et al. [1995], you can use the following references for a better understanding of the design patterns. Remember, your prototype needs to impart information and knowledge on the patterns in their purest form. For example, do not use collapsed hierarchies unless you are illustrating why a collapsed hierarchy is necessary or should not be used for the particular use case.

- Huston `http://www.vincehuston.org/dp/`
- Tackling Design Patterns `https://www.cs.up.ac.za/cs/lmarshall/TDP/TDP.html` [Marshall and Pieterse, 2015]

4 Submission

Date issued: 2 October 2025

Updates issued: None

Deliverables: There are two deliverables, one that focusses on the development of the app for teaching a design pattern, and the second constituting the examination where you will present the rationale for the design of your app and a short demo of the app as well as the self reflection.

Due date: The design documentation for the app the *COS214 app* prototype need to be submitted on the morning of the first day of the exam. An upload will be made available. The presentation needs to be uploaded before you present and the self reflection before 20:00 on the last day of the exam.

5 Assessment

Your Assignment 3 will be marked on the documentation, the *COS214 app* that has been submitted, supplemented by the demo of the app. The exam will be evaluated on the presentation, the demo of the app and how you applied what you learnt in the module to the app, and your self reflective report.

References

E. Gamma, R. Helm, R. Johnson, and J. Vlissides. *Design Patterns: Elements of Reusable Object-oriented Software*. Addison-Wesley Longman Publishing Co., Inc., Boston, MA, USA, 1995. ISBN 0-201-63361-2.

A. N. Kumar, R. K. Raj, S. G. Aly, M. D. Anderson, B. A. Becker, R. L. Blumenthal, E. Eaton, S. L. Epstein, M. Goldweber, P. Jalote, D. Lea, M. Oudshoorn, M. Pias, S. Reiser, C. Servin, R. Simha, T. Winters, and Q. Xiang. *Computer Science Curricula 2023*. Association for Computing Machinery, New York, NY, USA, 2024. ISBN 9798400710339.

L. Marshall and V. Pieterse. Tackling design patterns, 2015. URL `https://www.cs.up.ac.za/cs/lmarshall/TDP/TDP.html`.