Lab 1 Handout: Dependency Analysis and Dependency Graphs

Due: 30 April 2023

1 Objectives

- Figure out the dependencies among modules/classes/functions given the source code of a software application.
- Analyze the dependencies of the order line allocation's architecture in Chapter 4 of our textbook. Understand the *Thin Web Controller Principle*.
- EnglishPal
  - Analyze the dependencies of the EnglishPal's latest architecture (GreaterCold2023).
  - Analyze the dependencies of the EnglishPal's old architecture (ColdDew).
  - Compare the above two architectures. Which one looks better, GreaterCold2023 or ColdDew?

2 Task description

2.1 Big Ball of Mud

We want to avoid the *Big Ball of Mud* anti-pattern in our software application. Here are three such anti-pattern examples: yarn-like dependency, silkworm cocoon-like dependency, and anglerfish-like dependency.

2.2 Architecture evolution

In this lab, we study the dependency relationships among modules (or classes/functions) of EnglishPal. You will need to analyze two versions of EnglishPal, i.e., ColdDew (2 years ago), and GreaterCold2023 (2 months ago). Their source code is available in this Gitea repository. You will focus on analyzing the `*.py` files in that repository. This study may help us understand the evolution of the architecture of EnglishPal.

2.2.1 The module-level dependency

We say module A depends on module B if module A *uses* stuff from module B. In Python, the `import` statement is a good indicator of dependency.

This module-level dependency could be captured by tools such as Snakefood. Read the Snakefood user manual and generate a dependency graph for each version of EnglishPal.

2.2.2 The class/function-level dependency

Module-level dependency analysis could be carried out using Snakefood. How about class-level or function-level dependency analysis? X-Ray seems to be a nice one. However, it is for analyzing Java code only. If you cannot find a good tool, please manually draw a class/function-level dependency graph for each version of EnglishPal using Mermaid.

2.2.3 Comparing GreaterCold2023 with ColdDew

Fill out Table 1. From a scale 1 (worst) to scale 5 (best), how would you evaluate the architectural health of each version of EnglishPal? Which version of EnglishPal is easier to understand and maintain? Explain in no more than 3 sentences.

2.3 The textbook software architecture

Repeat the module-level dependency analysis and the class/function-level dependency analysis for the source code in Chapter 4 Our First Use Case: Flask API and Service Layer.

You only need to analyze the following source code files:

- `flask_app.py`

Table 1: Comparing five aspects between the two versions of EnglishPal, ColdDew and GreaterCold2023.

	ColdDew	**GreaterCold2023**
Lines of code in main.py (excluding blank lines and comments)		
Number of HTML files in folder templates		
Has a service layer? Answer Yes or No.		
Front-end and back-end coupling. Answer Strong or Weak.		
Number of module-level dependencies		

- `services.py`
- `model.py`
- `orm.py`
- `repository.py`

Use this command `git clone https://github.com/cosmicpython/code.git && cd code && git checkout chapter_04_service_layer` to get the code.

3 Requirements

- Do the lab in a group. The group must be the same as your course project group.
- Your lab report must follow the structure described in How to Write a Computer Science Lab Report.
- Proofread your lab report before submitting it. Make sure it contains no typos and grammar errors. You make lose marks if I see these typos and errors.
- Your lab report must contain the following content:
    1. A dot file (e.g., snakefood-colddew.dot) for *each* module-level dependency graph, as well as a graph rendered by Graphviz. You can render the graph using Graphviz Online.
    2. A text file (e.g., mermaid-colddew.txt) for *each* class/function-level dependency graph, as well as a graph rendered by Mermaid Live Editor.
    3. Note that you can insert both snakefood-colddew.dot and mermaid-colddew.txt as code snippets into the report. Repeat this for the GreaterCold2023 version of EnglishPal, and for the order line code in Chapter 4.
    4. Completed Table 1.
    5. Answers to the questions in section 2.2.3.
    6. Pros and cons of the current architecture of EnglishPal, GreaterCold2023.
- Submit your lab report (in PDF format) to schools's Cloud. Do not forget to include your group information in your report. Do not miss any group member's name.