

National Taiwan Normal University  
Department of Computer Science and Information Engineering  
CSC0005, Homework 2

## Information

1. The assignment is worth 100 points.
2. Individual or team (2-5 people) work, and each person can be individual or join one team.
3. Due at 12:00 on 4/11, i.e., Thursday noon.
4. Submit one copy if you work in a team, and then you are graded as a team.
5. Write the report in English or Chinese MS Word or PDF format.

## Content

1. Draw a UML class diagram that models the following statements.
  - (a) (15 points) A is a subclass of B. A implements an interface C which is used by D to access A. B is associated with one or more Es.
  - (b) (15 points) A CargoPlane aggregates zero or more Pallets. Each Pallet aggregates zero or more Boxes. A CargoPlane is composed of one or more Parts. Each Box contain one or more Items that are accessed by part numbers.
  - (c) (15 points) A University is composed of one or more Units, such as Colleges and Schools. Each Unit contains Faculty, Students, and Staff. A Unit maintains an AddressBook filled with Entries, and one Entry for each type of Person contained in that Unit. An Entry can be located in the AddressBook by supplying their last Name or their UniversityId. Faculty members can be the adviser of zero or more Students.
2. (15 points) Imagine we have a system that has a class called Shape and three subclasses Square, Circle, and Triangle each developed by a different software engineer. The system uses the classes to create randomly generated visualizations that balance various constraints concerning the area and perimeter of each individual shape along with the total area and total perimeter of all shapes on the screen. An example of such a constraint might be that the total area of all shapes must always be twice as large as the total perimeters. One engineer, feeling capricious, decides to implement the `getArea()` method of the Square subclass by having it return the perimeter of the Square instead. What design heuristic has this engineer violated and what repercussions will it have in the overall system?

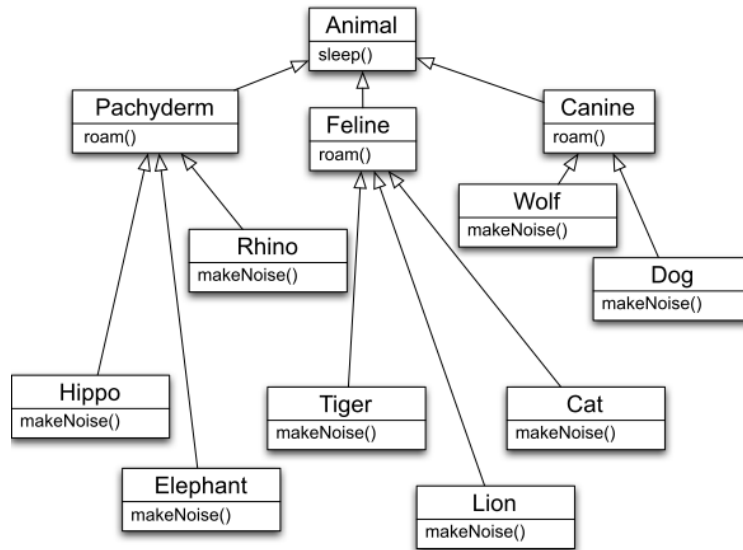


Figure 1: Animals with inheritance

3. Study the following UML class diagram in Figure 1. Consider to modify the **Animal** hierarchy to provide pet-related operations, **play()** and **takeForWalk()**, to the **Dog** and **Cat** classes. For the following approaches, draw the UML class diagram and describe the design trade-off.
  - (a) (20 points) Add pet-related methods to the **Animal** class.
  - (b) (20 points) Make a **Pet** interface which contains the **play()** and **takeForWalk()** methods, and only the **Dog** and **Cat** classes implement it.