Programmering og Problemløsning
Datalogisk Institut, Københavns Universitet
Uge(r)seddel 10 - group opgave

Jon Sporring and Christina Lioma

16. december – 20. december.
Afleveringsfrist: onsdag d. 21. december kl. 22:00

I denne periode skal I arbejde i grupper. Formålet er at arbejde med:

- Inheritance
- UML diagrams

Opgaverne for denne uge er delt i øve- og afleveringsopgaver.

Øve-opgaverne er:

10ø.0 Write a `Person` class with data attributes for a person's name, address, and telephone number. Next, write a class named `Customer` that is a subclass of the `Person` class. The `Customer` class should have a data attribute for a customer number and a Boolean data attribute indicating whether the customer wishes to be on a mailing list. Demonstrate an instance of the `Customer` class in a simple program.

10ø.1 Write an `Employee` class that keeps data attributes for the following pieces of information:

- Employee name
- Employee number

Next, write a class named `ProductionWorker` that is a subclass of the `Employee` class. The `ProductionWorker` class should keep data attributes for the following information:

- Shift number (an integer, such as 1 or 2)
- Hourly pay rate

The workday is divided into two shifts: day and night. The shift attribute will hold an integer value representing the shift that the employee works. The day shift is shift 1 and the night shift is shift 2. Write the appropriate methods for each class.

Once you have written the classes, write a program that creates an object of the `ProductionWorker` class and prompts the user to enter data for each of the object's data attributes. Store the data in the object and then use the object's methods to retrieve it and display it on the screen.

10ø.2 Extend the previous exercise as follows: Let a shift supervisor be a salaried employee who supervises a shift. In addition to salary, the shift supervisor earns a yearly bonus when his or her shift meets production goals. Write a `ShiftSupervisor` class that is a subclass of the `Employee` class you created in the previous exercise. The `ShiftSupervisor` class should keep a data attribute for the annual salary and a data attribute for the annual production bonus that a shift supervisor has earned. Demonstrate the class by writing a program that uses a `ShiftSupervisor` object.

10ø.3 **(Extra difficult).** Considering that production during night shifts is reduced by 5% compared to production during day shifts, and that the hourly pay rate during night shifts is double the hourly pay rate during day shifts, compute the best possible worker & shift allocation over the period of 12 months. You need to think how to measure productivity and salary cost, and then find their best tradeoff in the period of 12 months.

10ø.4 Produce a UML diagram for each of the above exercises.

Afleveringsopgaven er:

10g.0 Cheetahs, antelopes and wildebeests are among the world's fastest mammals. This exercise asks you to simulate a race between them. You are not asked to simulate their movement on some plane, but only some of the conditions that affect their speed when running a certain distance.

Produce a UML diagram representing the following.

Your base class is called `Animal` and has these attributes:

- The amount of food needed daily (measured in kilograms) *max_food*
- The weight of the animal (measured in kilograms) *weight = input_weight (+ food?)*
- The maximum speed of the animal (measured in kilometres per hour) *max_speed*
- The current speed of the animal (measured in kilometres per hour) *speed*

The `Animal` class should have a primary constructor that takes two arguments: the animal's weight and the animal's maximum speed. The `Animal` class should also have an additional constructor that takes as input only the animal's maximum speed and generates the animal's weight randomly within the range of 70 - 300 kg. The `Animal` class should have two methods: *new max_speed = …*

- The first method should set the current speed of the animal proportionately to its food intake and maximum speed as follows: if the animal eats 100% of the amount of food it needs daily, the animal's current speed should be its maximum speed; if the animal eats 50% of the amount of food it needs daily, the animal's current speed should be 50% of its maximum speed, and so on. *speed = food/max_food * max_speed*
- The second method should set the amount of food needed daily proportionately to the animal's weight as follows: the animal should eat half its own weight in food every day (if the animal weighs 50 kg, it should eat 25kg of food daily). *max_food = weight/2*

Create a subclass `Carnivore` that inherits everything from class `Animal`, and modifies the second method as follows: the animal should eat 8% of its own weight in food every day.

Create a subclass `Herbivore` that inherits everything from class `Animal`, and modifies the second method as follows: the animal should eat 40% of its own weight in food every day.

Create an instance of `Carnivore` called `cheetah` and two instances of `Herbivore` called `antelope, wildebeest`. Set their weight and maximum speed to:

- cheetah: 50kg, 114km/hour
- antelope: 50kg, 95km/hour
- wildebeest: 200kg, 80km/hour

*food = rand(0,1) * max_food*

Generate a random percentage between 1 - 100% (inclusive) separately for each instance. This random percentage represents the amount of food the animal eats with respect to the amount of food it needs daily. E.g., if you generate the random percentage 50% for the antelope, this means that the antelope will eat 50% of the amount it should have eaten (as decided by the second method).

For each instance, display the random percentage you generated, how much food each animal consumed, how much food it should have consumed, and how long it took for the animal to cover 10km. Repeat this 3 times (generating different random percentages each time), and declare winner the animal that was fastest on average all three times. If there is a draw, repeat and recompute until there is a clear winner.

Test all methods. You should include a UML diagram, comment your code and describe in max. 2 pages (excluding the UML diagram) what your program does and how you have tested the methods.

Optional extra: repeat the race without passing as input argument the weight of each animal (i.e. letting the additional constructor generate a different random weight for each instance).

Afleveringsopgaven skal afleveres som et antal fsx tekstfiler navngivet efter opgaven, som f.eks. `10g0a.fsx`. Tekstfilerne skal kunne oversættes med fsharpc, og resultatet skal kunne køres med mono. Funktioner skal dokumenteres ifølge dokumentationsstandarden. Hvis der er mere end 1 fsx-fil, så skal de samles i en zip-fil. Der skal

også laves en kort beskrivelse af løsningen for hver opgave i Latex som afleveres ved siden af zip-filen i pdf format. Begge filer uploades til Absalon.

God fornøjelse.