Course 12-746
Python Prototyping for Infrastructure Systems

Fall 2016

Assignment 2 (Total: 8 points)

Due: Tuesday, Sept. 20th, by blackboard by the end of day. For each day the assignment is late, a penalty of 10% of your total grade will be deducted.

Task 1 (3 point) *Object Oriented Programming in Python*

Please use the five Python modules that are provided (Assignment2_Task1.zip) with this assignment to finish the following questions.

a. The app.py module is currently an empty file. Please create one instance for the class advisor, class Student, and class Course. Fill in the necessary information for each instance. Then run the printDetail() method for the student and advisor. (1 pt)
b. The Student, Advisor and Staff classes have similar attributes and behaviors. Please create a parent class for them and save it to a new module. Rewrite three classes to inherit from the parent class. (1 pt)
c. Please create a package/folder named Academic, and put the Student, Advisor, Staff and the new parent class to this package. Then modify the app.py module to use the new package. (1 pt)

Task 2 (5 point) *Transportation system in OOP*

The traffic network is simplified to *roads* and *intersections*. Each road is connected to exactly two *intersections*, and each *intersection* is the converging point of more than two *roads*.

- *Road* contains the following attributes:
    - ID, length, speed limit, height limit, weight limit, and the current vehicle volume (the total number of vehicles that are on the road). There are also two attributes Intersection_1 and Intersection_2 that are the ID of the two intersections that the road is connected to.
- *Intersection* contains the following attributes:
    - ID, current vehicle volume (the total number of vehicles that are waiting on the intersection).

There are generally two types of vehicles that are considered in the transportation analysis

- *Car*: need to consider the ID, height and speed.
- *Truck*: need to also consider the weight.

At any time, one vehicle can only appear on one road or intersection. Hence, the movement of vehicles on the transportation network can be simulated by assigning the ID

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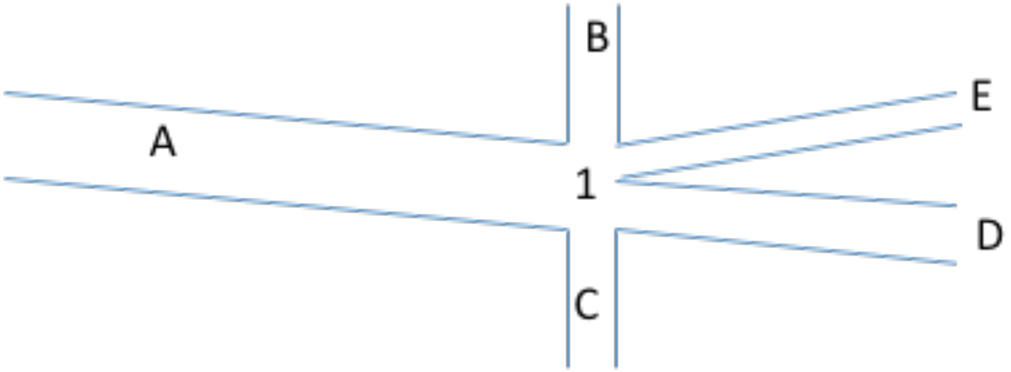
of a road or intersection to an attribute of the vehicle. For instance, a car may have an attribute called CurrentNetworkComponent, the value of which will be the ID of the road or intersection that this vehicle is currently on.

a. The app.py module is currently an empty file. Please create instances of road A, B, C, D and E, and the intersection 1, as shown in the following figure and table. Assuming that there is no vehicle on the roads or intersection yet. (1 pt)



Road ID	Length (ft)	Speed limit	Weight limit (ton)	Height limit
A	300	35	N/A*	13.5
B	90	25	10	N/A
C	90	25	10	N/A
D	155	15	N/A	N/A
E	160	15	N/A	10

*Note: if the value is N/A, it means that there is no limit. Please think about how to represent this value in the instance.

b. In the app.py module file, please add two instances of cars and one instance of the truck. (1 pt)

Car #1: Height is 5 ft. Currently running on road B with speed 24 mph.
Car #2: Height is 5.1 ft. Currently running on road A with speed 40 mph.
Truck #1: Height is 11.3 ft. Weight is 11 tons. Currently running on road E with speed 14 mph.

c. In order to check if the vehicles running on a road is allowed with the speed, weight and height limit, we need to implement several methods in the road class. The method checkSpeedLimit has already been implemented. It takes a parameter *car*, which should be an instance of the Car class, to check the speed limit. Please implement the other two methods checkWeightLimit and checkHeightLimit. (1 pt)

d. Simulation of a vehicle needs to calculate how much time it will take the vehicle to pass a road. But if the vehicle is not allowed to run on a road (e.g., exceed the speed limit or other limit), the results should be -1. Please complete the method

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time_on_road for both the class *Car* and *Truck* to use the parameter *road* to conduct this calculation. The parameter *road* should be an instance of the class Road. Hence, you should be able to access the attributes and methods of this instance. (1 pt)

e. Similar to the Task 1.b and 1.c, please create a superclass for the class *Road* and *Intersection*, and another superclass for the class *Car* and *Truck*. Then create a package named Network, and put the Road, Intersection and the new parent class to this package. Create another package named Vehicle and put the class Car, Truck and the new parent class there. Then modify the app.py module to use the new package. (1 pt)

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