Software Engineering (ISW)

Exam Theory. Act 1

28-10-2019

ETSInf-UPV

NAME:

Time: 2 hours 30 min

Questions *(3 points)*

1. (*1 point) An application may be designed using several layers*. Does this strategy have any disadvantage? Justify your answer.

2. *(1 point)* What advantages present evolutionary software development lifecycles (incremental or spiral) over a classic model with prototyping?

3. *(1 point)* Enumerate the software quality factors that are related to the adaptability to new environments. Explain briefly each one of them.

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Problems *(7 points)*

4. *(3.5 points)* The City Mobility Agency wants to build a system for controlling and managing the traffic flow in the city. To do so, it has a system that in real time by means of video cameras captures information related to traffic. The installed cameras have a serial number, a location (longitude and latitude), an IP address to obtain the video stream, a name, a horizontal and a vertical resolution measured in pixels. In the same location several cameras may be installed using a pole. In addition, if the camera may be remotely controlled (Pan-Tilt-Zoom cameras) there is also an IP address to send the control commands.
The system may detect passing vehicles by identifying their plate numbers automatically but without storing any image. Each time a plate number is detected, the system searches if it corresponds to an existing vehicle and, if so, the detection is registered containing the date and time, the identified vehicle and the camera that identified it. Vehicles detected by cameras have in the system a plate number, brand, model, horsepower and an environmental badge provided by the General Traffic Directorate (GTD) ("0", "ECO", "B", "C"). Each vehicle is registered in the system with an owner who has the following information: Id number, name, address, phone number and email address.

The town hall wants to implement a system of bonus/penalties to promote the progressive incorporation of non-polluting vehicles in the city. To do so, for each travelled kilometer, if the vehicle has a "0" or "ECO" badge a 0,05€ bonus per km is applied in the annual transportation tax, if it has a "C" badge then a 0,01€ bonus per km is applied, if it has a "B" badge a 0,01€ per km penalty is applied and if the car has no environmental badge then a 0,05 € per km penalty is applied. These reference bonus/penalties are stored in the system and may be changed by the town hall at any time. The environmental badges may change and, therefore new bonus/penalization amounts can be added/removed if the GTD decides to add or remove an environmental badge. The town hall stores for each environmental badge not only the amount of bonus/penalty per km but also the code associated to the badge, a description of the badge and its color. For those vehicles without a GTD badge the town hall has created a special badge with color "Black", code "X" and description "Polluting Vehicle".

For each vehicle the system generates and stores annually a receipt that contains the year, the total amount of kms travelled with the vehicle and the total amount of money to pay/receive (depending on whether this amount is positive or negative) in the annual transportation tax of the vehicle. In addition to vehicles having a plate number, there are also other vehicles such as bikes and electric scooters that have no plate number, but they do have an environmental badge "0" or "ECO". These vehicles are stored in the system with a brand, model, horsepower, a text description ("Electric Scooter", "Bike", etc.) and its owner. These vehicles have a GPS receiver connected to the town hall system. Periodically, the system detects these vehicles and stores their location (longitude and latitude), the date and time of the detection. For these vehicles it is also generated an annual receipt as described before.

Obtain the UML class diagram including the necessary attributes and the names of all the relationships (**do not include any class methods or any attribute types**).

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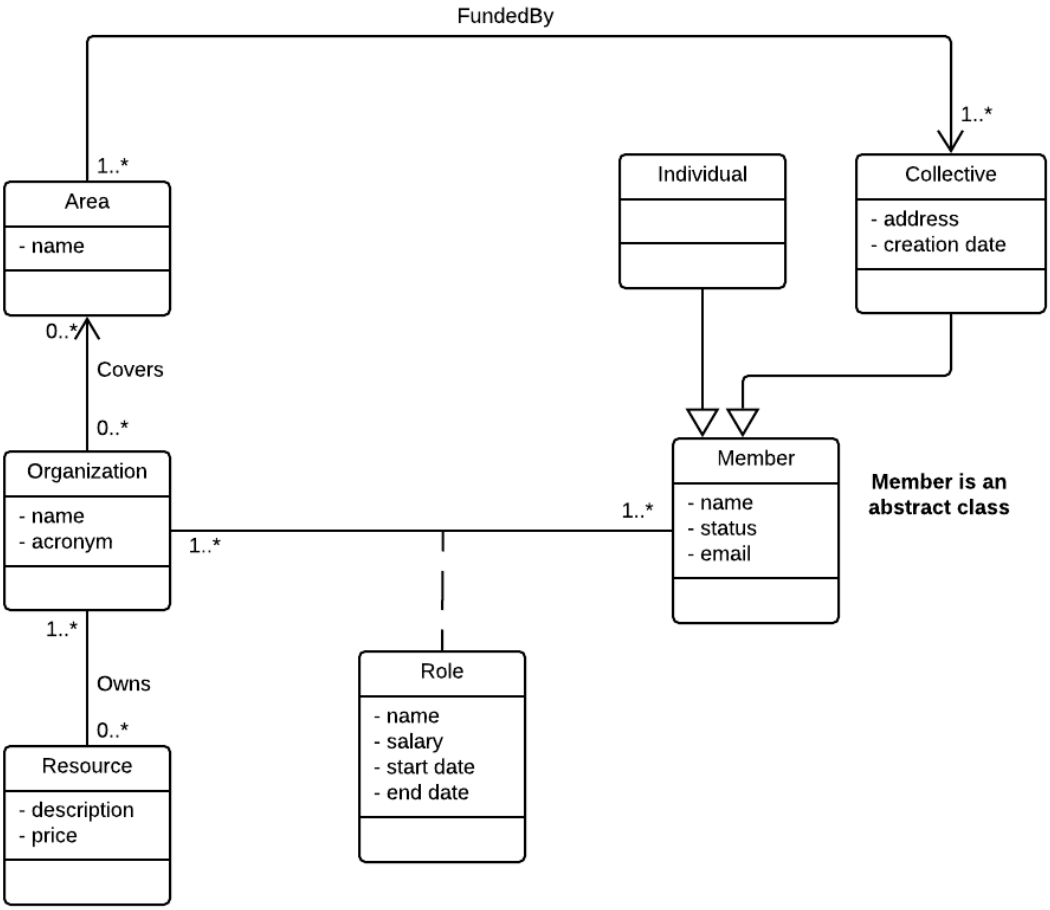
5. *(3.5 points)* Given the following UML class diagram:



Note 1. There is a navigation restriction between Organization → Area & Area → Collective.

a) *(1.5 points)* Obtain the C# object design. Use any reasonable attribute types.

b) *(1 point)* Define the headers of the constructors.

c) *(1 point)* Implement the necessary code so that an organization for a collective member is created. Use any arbitrary values for the required parameters leaving a consistent system after its execution.