Conceptual modelling Solution example

The objective of this task is to construct a conceptual schema of a simple database domain described below. To draw a conceptual schema use a notation of simplified UML class diagrams presented and explained to you during the lecture classes in CSCI235/MCS9235. Remember to determine the names of classes of objects, the names of associations, the names of attributes, identifiers, multiplicities of associations, qualifications, and generalization hierarchies.
Application of electronic drawing tools, CASE systems, etc is NOT compulsory. A neat hand drawing prepared on a piece of paper is acceptable.

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A database should contain information about the pet animals
and their owners.
The first name, last name, phone number, and address describe
an owner of an animal. An address consists of a suburb name,
street name, building number, and optional flat number. A pair
of attributes: first name and last name uniquely identifies an
owner. A phone number can also be used to identify an owner.
An owner owns one or more animals. An animal has only one
owner. The database should contain information about the
present owner of an animal and date when an owner purchased an
animal.
We consider only two sorts of animals: dogs and cats. A dog is
described by a name, breed, year when born, and registration
number. A cat has the same description as a dog and
additionally it is described by a colour.
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It is not allowed to add any artificial identification attributes to the specification given above. To create a conceptual schema we *read through* a specification several times and each time we "discover" the basic components of a conceptual schema. A solution given below discovers the classes of objects and class hierarchies in the first pass, associations in the second pass, attributes in the third pass, identifiers and   qualifications in the fourth pass. Finally, in the last pass, we integrate the intermediate results, eliminate redundant information, and perform the final refinements. It is a long and tedious way to construct a conceptual schema. It is worth go through it at least one time. An exhaustive analysis of a sample database domain makes conceptual modelling elementary simple.

Pass 1
Find the classes of objects and generalization hierarchies

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A database should contain information about the pet animals
and their owners.
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New classes of objects: ANIMAL, OWNER

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The first name, last name, phone number, and address describe
an owner of an animal. An address consists of a suburb name,
street name, building number, and optional flat number. A pair
of attributes: first name and last name uniquely identifies an
owner. A phone number can also be used to identify an owner.
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An owner owns one or more animals. An animal has only one
owner. The database should contain information about the
present owner of an animal and date when an owner purchased an
animal.

We consider only two sorts of animals: dogs and cats. A dog is
described by a name, breed, year when born, and registration
number. A cat has the same description as a dog and
additionally it is described by a colour.

New classes of objects: DOG, CAT

New generalization hierarchies: DOG IS-A ANIMAL, CAT IS-A ANIMAL

Pass 2
Find the associations

A database should contain information about the pet animals
and their owners.

New associations: OWNER OWNS ANIMAL,

The first name, last name, phone number, and address describe
an owner of an animal. An address consists of a suburb name,
street name, building number, and optional flat number. A pair
of attributes: first name and last name uniquely identifies an
owner. A phone number can also be used to identify an owner.

New associations: none

An owner owns one or more animals. An animal has only one
owner. The database should contain information about the
present owner of an animal and date when an owner purchased an
animal.

New associations: none

We consider only two sorts of animals: dogs and cats. A dog is
described by a name, breed, year when born, and registration
number. A cat has the same description as a dog and
additionally it is described by a colour.

New associations: none

Pass 3

Find the attributes

A database should contain information about the pet animals and their owners.

New attributes: none

The first name, last name, phone number, and address describe an owner of an animal. An address consists of a suburb name, street name, building number, and optional flat number. A pair of attributes: first name and last name uniquely identifies an owner. A phone number can also be used to identify an owner.

New attributes: OWNER(first-name, last-name, phone, suburb, street, building#, flat#[0..1])

An owner owns one or more animals. An animal has only one owner. The database should contain information about the present owner of an animal and date when an owner purchased an animal.

New attributes: OWNS(when-purchased)

Because an association OWNS is *one-to-many*, an attribute when-purchased can be moved to a description of a class on *many* side of association, i.e. ANIMAL.

We consider only two sorts of animals: dogs and cats. A dog is described by a name, breed, year when born, and registration number. A cat has the same description as a dog and additionally it is described by a colour.

New attributes: ANIMAL(name, breed, yborn, rego#),
DOG(name, breed, yborn, rego#),
CAT(name, breed, yborn, rego#, colour)

Due to the generalizations DOG IS-A ANIMAL and CAT IS-A ANIMAL common attributes from the classes DOG and CAT can be removed.

New attributes: ANIMAL(name, breed, yborn, rego#),
DOG()
CAT(colour)

Pass 4
Find the identifiers

A database should contain information about the pet animals and their owners.

New identifiers: none

The first name, last name, phone number, and address describe an owner of an animal. An address consists of a suburb name, street name, building number, and optional flat number. A pair of attributes: first name and last name uniquely identifies an owner. A phone number can also be used to identify an owner.

New attributes: OWNER.ID1 =(first-name, last-name)
OWNER.ID2 = (phone)

An owner owns one or more animals. An animal has only one owner. The database should contain information about the present owner of an animal and date when an owner purchased an animal.

New identifiers: none

We consider only two sorts of animals: dogs and cats. A dog is described by a name, breed, year when born, and registration number. A cat has the same description as a dog and additionally it is described by a colour.

New identifiers: ANIMAL.ID1 = (rego#)
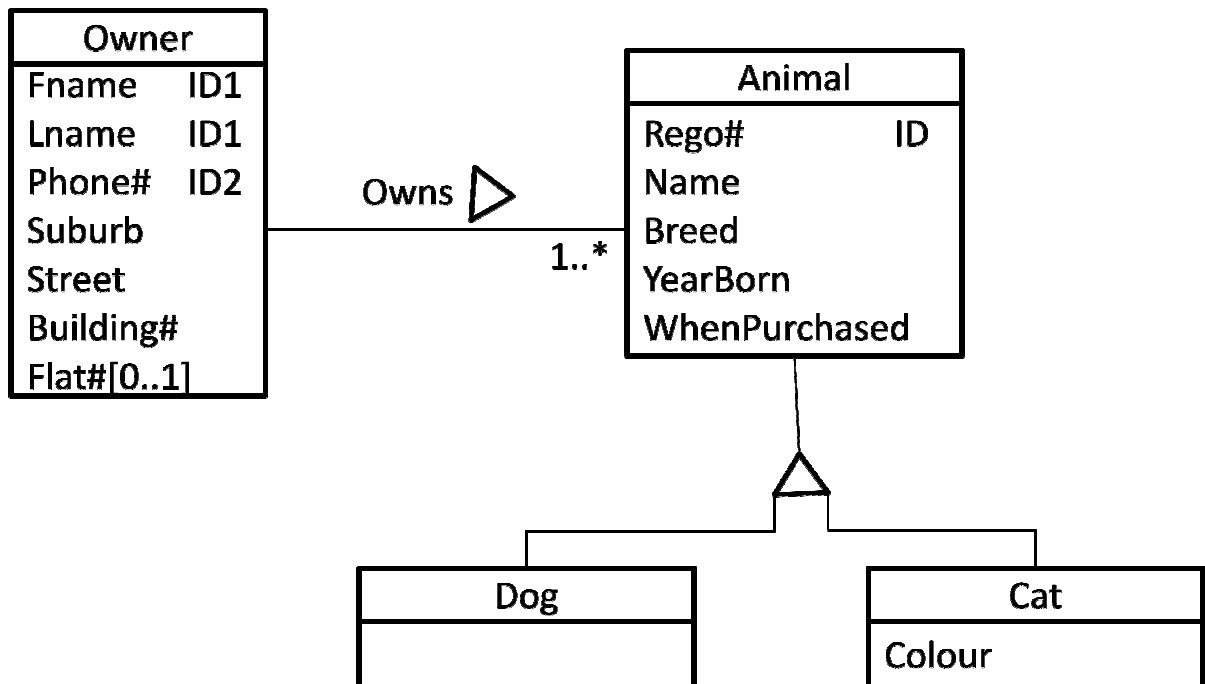
Pass 5
Find the qualifications of associations

New qualification: none.

Pass 6
Find the generalizations

New generalization: none.

The final conceptual schema:

Owner	
Fname	ID1
Lname	ID1
Phone#	ID2
Suburb	
Street	
Building#	
Flat#[0..1]	

Owns ▷

1..*

Animal	
Rego#	ID
Name	
Breed	
YearBorn	
WhenPurchased	

Dog

Cat
Colour

End of solution