Big Oil Example from exercises
Requirements

We use drones to go locate oil on the sea floor. Operators send instructions to the drones. Each drone contains a sensor to collect data about the sea floor. The drones can be instructed to move about the ocean floor, report their position via GPS, hold their position and take measurements. The sensors can be instructed to send back data to the user, but depending on the type of data collected, the retrieval behaves differently. The two types of sensors (sonar and teledensitometer) are described below.

Sonar sensors generate a pulse of sonic energy and listen for the echoes. The readings are very storage intensive – only one reading may be stored at a time. This reading may be retrieved or overwritten.

Teledensitometer sensors (TD) generated readings on a continuous process. Data is stored in a temporary buffer. The operator can instruct the TD to verify that the buffer has sufficient data for an accurate measurement. The operator can then discard the buffer data, add more to it, or archive it in one of 5 storage locations. Appending data to a buffer can corrupt the data if all does not come from the same target area.
Identify nouns:

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(Add some specifications)
Data consists of floating-point numbers of 32-bit precision. Positions are classes and based on GPS data. Operator will send messages to the drones and get messages back.

List Nouns
QUESTION: does the noun represent a class that is relevant to the design of the system?
1. drone
2. sea floor
3. operator
4. data
5. GPS position
6. measurements
7. sensor
   a. sonar sensor
   b. TD sensor
8. pulse
9. echo
10. readings
11. storage
   a. temporary buffer
   b. storage locations

Identify central nouns/objects
1. drone (central to story)
2. sea floor
3. operator
4. data (this is state of the storage – storage has-a collection of data )
5. GPS position (this is state of the drone – drone has-a GPS position)
6. measurements (state)
7. sensor (central to activity)
   a. sonar sensor
   b. TD sensor
8. pulse
9. echo
10. readings (like data)
11. storage (state of sensor)
   a. temporary buffer (types of storage)
   b. storage locations (types of storage)

Identify state and behavior of key objects (answer the question X has-a Y and what does X do?)

1. Drone
   a. State
      i. GPS position
      ii. Sensor
   b. Behavior
      i. Turn
      ii. go forward
      iii. go backward
      iv. stop
      v. report position
      vi. take measurement
      vii. talk to sensor
      viii. get sensor data

2. Sensor
   a. State
      i. storage
   b. Behavior
      i. collect
      ii. retrieve

With similar types of objects, try to identify ISA-a relationships and extension of state and behavior

Sensor
1. Sonar Sensor is-a sensor
   a. State
      i. storage – buffer
   b. Behavior
      i. collect
ii. retrieve

2. TD Sensor is-a sensor
   a. State
      i. storage – buffer
      ii. 5 chunks of storage
   b. Behavior
      i. collect (can append, too)
      ii. retrieve
      iii. verify
      iv. discard or clear
      v. move to store
      vi. retrieve from store
      vii. clear store

Create a class diagram

Class has identity, state, behavior

Show a class

Do the same for the sensor class
Now, need to identify relations:

An association
permanent relationship
drone and sensor are permanently associated

key is, how are they associated.
Use Has-a (state) to identify association
Drone has-a sensor
You might say association between sensor and drone goes both ways. The car example has this type of thing.

Here, though, the association is based on who can call whose methods. Drone can call Sensor, but not vice versa.

How about dependency? This relationship models local variables or parameters. We might model the operator and her behavior. At certain times, the operator has a drone, and at others, the operator does not. You would not say that in modeling the operator, the operator HAS-A drone as permanent state.
**Generalization or inheritance**

This relation looks at whether something IS-A something else. We have Sonar Drones and TD Drones.

These pretty much behave the same way, from the operator point of view, but, of course, the operator will talk to each sensor in different ways. The only difference is the type of sensor.

So, we need to represent both types of Drones, i.e., a sonar drone and a TD drone.
Similarly, there are different types of Sensor, sonar and TD, each of which ISA sensor, so we show this relationship as inheritance.