CSC 2210
Object Oriented Analysis & Design

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CRC Cards

>> What is CRC Card?
>> CRC Team
>> CRC Process
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>> CRC Card Example

What is CRC Cards?

>> **CRC** means

- **C**lass
- **R**esponsibilities
- **C**ollaborations

>> The **CRC** methodology was originally developed as a learning tool during the time when object-oriented programming was new; a lot of procedural programmers needed help making the transition to OO thinking. The goal was to provide the simplest possible conceptual introduction to OO modeling.

>> **Kent Beck and Ward Cunningham** first introduced CRC cards at OOPSLA ’ 89 in their paper “*A Laboratory for Teaching Object-Oriented Thinking*”. Originally their purpose was to teach programmers the object-oriented paradigm.

What is CRC Cards?

>> The heart of the method is the CRC card.

>> A CRC card is a 3-x-5" or 4-x-6" lined index card.

>> The physical nature of the cards emphasizes the division of responsibility across objects.

>> The physical size of the cards also helps to establish limits for the size and complexity of the classes.

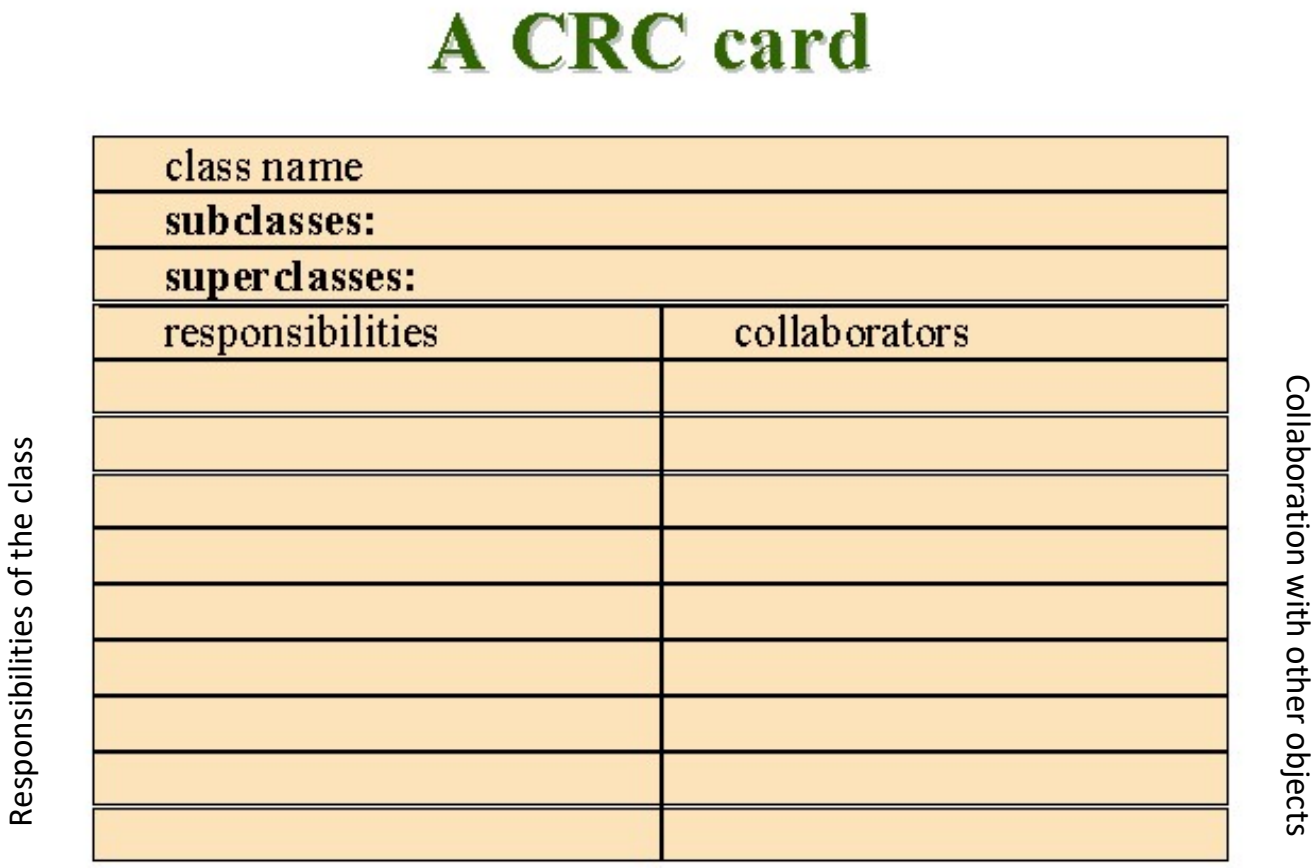
>> The CRC card technique does not use the UML. Instead it is used to discover information about classes that is then placed into a UML Class diagram.

>> The body of the card is divided in half.

-left column/half lists the responsibilities of the class

- right column/half lists the other objects that it works with, the collaborators, to fulfil each responsibility

What is CRC Cards?



>> The class name is written at the top of the card.

>> The next two lines are reserved for the listing of superclasses and subclasses.

>> The back of the CRC card is often used for a more detailed description of the Class. Many time these include the actual attributes of the class.

What is CRC Cards?

Class :

A Class represents a collection of similar objects. The Class name appears across the top of the CRC card

Responsibility:

A Responsibility is anything that the class knows or does.

- what an object can do
- what an object knows

The Responsibilities of a class appear along the left side of the CRC card

Collaborator:

A Collaborator is another class that is used to get information for, or perform actions for the class at hand. It often works with a particular class to complete a step (or steps) in a scenario.

- how an object interacts with other objects to carry out a responsibility

The Collaborators of a class appear along the right side of the CRC card.

CRC Team

>> Generally three types of people requires in CRC team that includes

1. Domain Users
2. OO Design Analyst
3. Facilitator

>> Additional non-active participants can include a **scribe** and **observers**

CRC Team

Domain Users:

The domain users/experts provide knowledge of the subject area. They should have a good amount of business domain knowledge for which the system is being modeled. Good domain users also have the following characteristics:

- Know the business being modeled.
- Think logically.
- Good communication skills.
- Are willing to invest the time in systems designs.

OO Design Analyst:

These members of the CRC team are analysts or developers familiar with OO methodologies and techniques. Good Design analyst have the following characteristics:

- Understand the CRC modeling process and methodology.
- Understand the OO modeling process and methodology.
- Experience developing OO systems

CRC Team

Facilitator:

This is the member who runs the CRC session. This person is perhaps the most important member of the team. It is the facilitator' s responsibility to keep the CRC session progressing forward. Good facilitators have the following characteristics:

- Good meeting skills.
- Understand the CRC modeling process and methodology.
- Understand the OO modeling process and methodology.

Scribe:

This is the member responsible for documenting any business logic and discussion that isn't captured on the CRC Cards themselves. This documentation is often rolled back into the requirements and business case documents, as well as used by the design analysts to further the systems object model. Good scribes have the following characteristics:

- Listen extremely well.
- Good written communications skills
- Can identify business logic

CRC Team

Observers:

These are members who aren't directly participating in the CRC session.
They are generally other users of the system, or other project team members.
It is important that the facilitator ensure that these people are not active during the CRC session.
Good observers have the following characteristics:

- Know how to contain opinions during the modeling session, i.e. shut-up.

CRC Process

The CRC process centres on working through scenarios. The process breaks down into four stages:

Before the Scenario Execution

- The Problem: Everyone agrees on the problem definition.
- Brainstorming for Classes based on the problem statement
- Filtering Classes: The team works on definitions for each class, eliminating synonyms and conflicts.
- Assigning Cards: Each team member is assigned responsibility for one or more classes.

The Scenario Execution

- Each scenario expresses something that the system is supposed to do. The team walks through the scenario identifying the responsibilities of each class in the scenario.
- Each discovered responsibility is recorded on the card of the corresponding class.

During the Scenario Execution

Grouping the Cards: The team identifies similar classes.

Scenario List: The team reviews the scenario coverage for completeness.

Collaboration Drawings: The cards are combined on a wall or white board to show how they cooperate in the execution of the scenarios.

After the Scenario Execution

The team reviews the resulting model and plans the implementation.

CRC Strengths

>> It is still a valuable tool for helping a programmer transition from procedural to OO concepts.

>> It is extremely easy to use and very visual. It is difficult for any participant to claim he didn't know exactly what was going on.

>> The technique is very responsibility-driven. It keeps the participants focused on the value of an object based on what that object contributes to the proper operation of the system. The result is a system with the minimum number of objects needed to make it work.

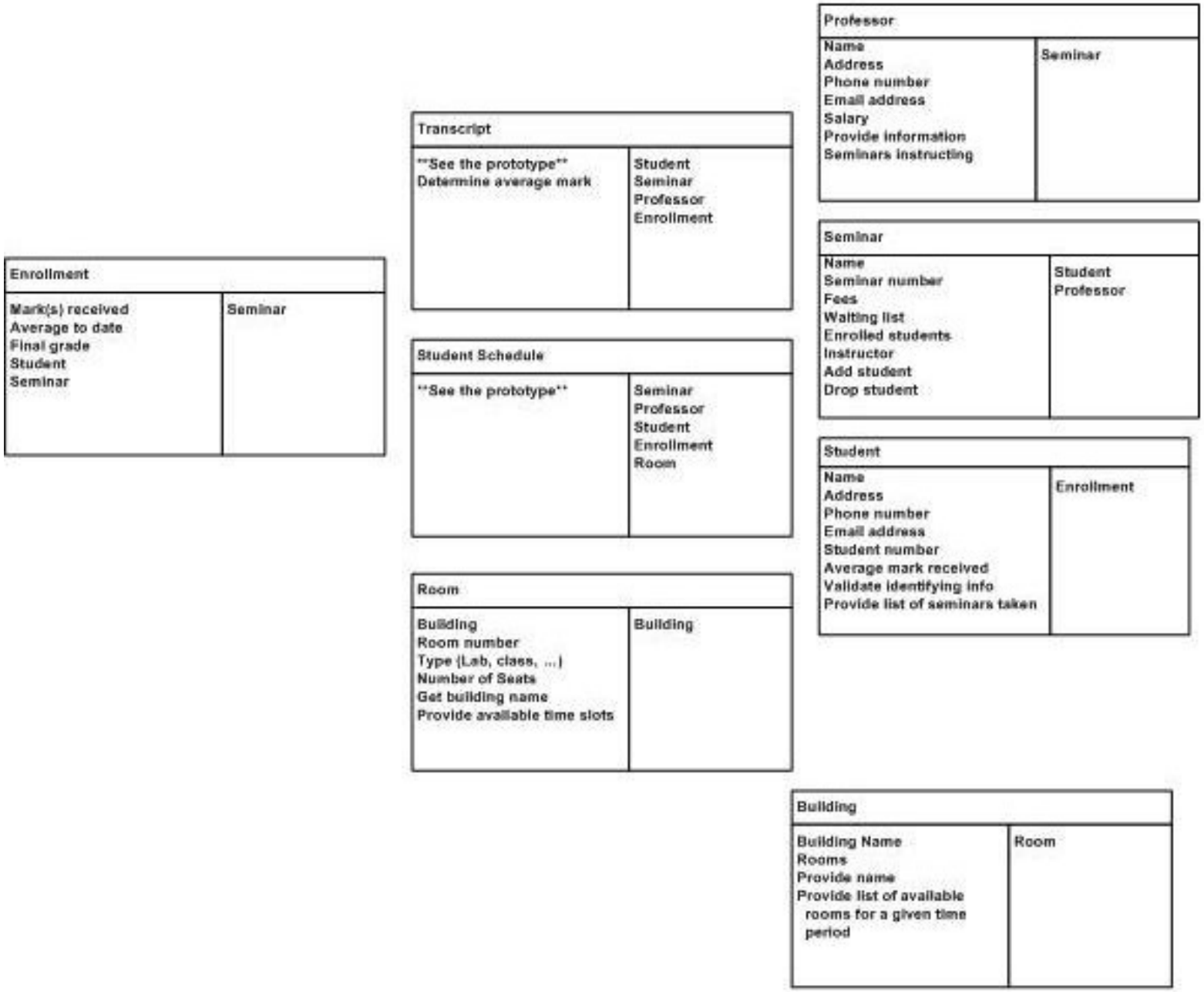
>> The technique helps the participants think like objects and to understand why objects work well or work poorly. This understanding helps ensure a good design.

CRC Card Modeling

>> Iteratively perform the following steps for creating CRC models :

- Find classes.
- Find responsibilities.
- Define collaborators.
- Move the cards around.

CRC Card Example



References

→ **Methodologies and Practices – White Paper**
Introduction to CRC Cards
By David M. Rubin