Constructing The Class (Object Model*) Diagram

The Object Model Diagram is a graphical representation of the classes within a system and the static or underlying relationships between them.

*original designation
The Class Diagram

- Class name
- Attributes
- methods

May be completed during design phase
Completed during the design phase
Associations Between Classes

One or more Student in a Course

<table>
<thead>
<tr>
<th>Student</th>
<th>Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>name</td>
</tr>
<tr>
<td>ID</td>
<td>number</td>
</tr>
<tr>
<td>major</td>
<td>credits</td>
</tr>
<tr>
<td>GPA</td>
<td>prereqs</td>
</tr>
<tr>
<td>credit_hr</td>
<td></td>
</tr>
</tbody>
</table>

Students take 0 or more courses
Cardinality Constraints

* \rightarrow Zero or more

+ \rightarrow One or more \text{ Rumbaugh’s notation}

\bigcirc \rightarrow Zero or one \text{ Rumbaugh’s notation}

1..4 \rightarrow Explicit cardinality
Examples

All Course objects have a professor and at least 1 student

In any semester a professor will teach zero or more courses

Students may take up to 6 courses
Examples

Associations read from left to right and top to bottom

Professor 1 teaches Course *

Student + takes Course 0..6
Relationship Attributes

Better – model salary as a relationship attribute
Every person has 2 parents and zero or more children
A Librarian issues a Card to a Patron. The Card is uniquely assigned to a particular Patron.
Aggregation

UML Notation

```
Aggregation

Component 1

Component 2

Component 3

Aggregate Class

* + 3
```
Aggregation

A solid diamond is used to represent composition where the composite solely owns the part.

A hollow diamond is used to indicate the composite end may be more than one. The part may appear *simultaneously* in more than one composite.
Qualification to Remove Multiplicity

The qualifier is a special attribute that limits the multiplicity of an association.

The qualifier distinguishes among the set of objects at the many end of an association.
A directory contains zero or more files

Multiplicity can be removed by the qualifier *file name* which uniquely identifies a single file.
Qualification

Multiplicity is removed by the qualifier
Classes having the same attributes may be generalized to a common ancestor class.
Generalization and Specialization

A sea plane travels in the air and on water
Generalization and Specialization

A filled triangle indicates that some objects belong to more than one of the subclasses (subclasses overlap)

An empty triangle indicates that all objects of the parent class belong to distinct subclasses
Constructing the Object Model Diagram

Step 1

Determine the objects in the problem domain from the requirements document.
Example -- Arithmetic Expression

Requirements Document

An arithmetic expression is a collection of one or more terms separated by additive operators. A term is a sequence of one or more factors separated by multiplicative operators. A factor is a variable, or a constant, or an arithmetical expression enclosed in parentheses.
Example -- Arithmetic Expression

An arithmetic expression is a collection of one or more terms separated by additive operators. A term is a sequence of one or more factors separated by multiplicative operators. A factor is a variable, or a constant, or an arithmetic expression enclosed in parentheses.
Arithmetic Expression

Noun Phrases

Arithmetic expression \( \rightarrow \) object

term \( \rightarrow \) object

additive operator \( \rightarrow \) object

factor \( \rightarrow \) object

multiplicative operator \( \rightarrow \) object

variable \( \rightarrow \) object

constant \( \rightarrow \) object

enclosed in parentheses \( \rightarrow \) constraint
Arithmetic Expression

arithmetic expression is a sequence of terms

terms are separated by additive operators

term is a sequence of factors

factors are separated by multiplicative operators

factor is a variable

factor is a constant

factor is a arithmetic expression {enclosed in parentheses} constraint
Model Diagram

Arithmetic Expression

Term + Add_op

Factor + Term

Mult_op connected-by 2

A factor “is-a”

Variable

identifier

Constant

value