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Object-Oriented Relations

- “Object-orientation” is about instantiation.
- Instantiation is needed for programming language “functions” with state.
- Such states are values of stored variables, or attributes.
- Database relations are stored values: a state could be a tuple.
- It could also be a tuple of a nested relation; or a subrelation.
- Thus, nesting is usually a part of OODB, called complex objects.
- Aldat has nesting, in ways efficient for secondary storage.
- Aldat also can instantiate, in bulk, computations with state.
- Instances form classes.
- Classes may contain each other: inheritance can save code.
Relations as Classes

relation Couch(Id, Length, Width);
relation Chair(Id, Base);
relation Furniture(Id, Manuf);
Couch isa Furniture;
Chair isa Furniture;

Now the projection,

[Manuf] in Couch

is syntactic sugar for

[Manuf] in (Couch natjoin Furniture)

and similarly for any other use of Manuf in Couch or Chair

<table>
<thead>
<tr>
<th>Furniture</th>
<th>Couch</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Id  Manuf)</td>
<td>(Id  Length  Width)  Manuf</td>
</tr>
<tr>
<td>1  Mobel</td>
<td>1  15  5  Mobel</td>
</tr>
<tr>
<td>2  Furn</td>
<td>2  17  5  Mobel</td>
</tr>
<tr>
<td>3  Mobel</td>
<td>3  18  6  Mobel</td>
</tr>
<tr>
<td>21  Mobel</td>
<td></td>
</tr>
<tr>
<td>22  Furn</td>
<td>Chair (Id  Base)  Manuf</td>
</tr>
<tr>
<td></td>
<td>21  4  Mobel</td>
</tr>
<tr>
<td></td>
<td>22  5  Furn</td>
</tr>
</tbody>
</table>

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Inheritance as join

- Inheritance could also be implemented as a join,

- but most such O-O uses are low activity operations,

- and best implemented with pointer dereferencing instead of the full join.

- So the special case of O-O gets a special implementation:

- another example of syntactic sugar hiding specialized algorithms and data structures,

- although defined in terms of the general operator.
Inheritance as join

Here is a variant.

```
relation Couch(Id, Length, Width);
relation Furniture(Fid, Manuf);
Couch [Id isa Fid] Furniture;
```

```
[Manuf] in Couch
is syntactic sugar for
[Manuf] in (Couch [Id natjoin Fid] Furniture)
```

- So `isa` translates directly into a precise, if possibly complex, specification for natural join.

- Inclusion dependence,

```
[Id] in Couch ⊆ [Fid] in Furniture
```

is not guaranteed: this would move `isa` from a purely syntactic specification to a `semantic` constraint.
Attaching Computations to Classes—Polymorphism (a sketch)

comp PolyArea(Area) is
{ comp Area(A) is
    { A ← Length×Width; };   \(\ll\) public variables
} also
{ comp Area(A) is
    { A ← Base**2; };   \(\ll\) —not hidden
};

FurnMethod ← Furniture natjoin PolyArea;
Couch isa FurnMethod;
Chair isa FurnMethod;
let FootPrint be Area{}
CouchPrint ← [Id, FootPrint ] in Couch;
ChairPrint ← [Id, FootPrint ] in Chair;

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### FurnMethod

<table>
<thead>
<tr>
<th>Id</th>
<th>Manuf</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mobel</td>
<td>:</td>
</tr>
<tr>
<td>2</td>
<td>Furn</td>
<td>:</td>
</tr>
<tr>
<td>3</td>
<td>Mobel</td>
<td>:</td>
</tr>
<tr>
<td>21</td>
<td>Mobel</td>
<td>:</td>
</tr>
<tr>
<td>22</td>
<td>Furn</td>
<td>:</td>
</tr>
</tbody>
</table>

### CouchPrint

<table>
<thead>
<tr>
<th>Id</th>
<th>FootPrint</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>75</td>
</tr>
<tr>
<td>2</td>
<td>85</td>
</tr>
<tr>
<td>3</td>
<td>108</td>
</tr>
</tbody>
</table>

### ChairPrint

<table>
<thead>
<tr>
<th>Id</th>
<th>FootPrint</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>16</td>
</tr>
<tr>
<td>22</td>
<td>25</td>
</tr>
</tbody>
</table>

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