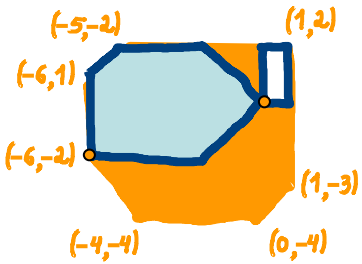
2nd ESICUP Meeting, Southampton, UK, April 14-16, 2005

```
<polygon id="nfp_h0_p1" nVertices="7">
    <vertices>
        <vertex x="-6.0" y="-2.0"/>
        <vertex x="-6.0" y="1.0"/>
        <vertex x="-5.0" y="2.0"/>
        <vertex x="1.0" y="2.0"/>
        <vertex x="1.0" y="-3.0"/>
        <vertex x="0.0" y="-4.0"/>
        <vertex x="-4.0" y="-4.0"/>
    </vertices>
</polygon>
```



A XML format for data representation in Nesting Problems

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Why a standard format?

- Make easier the use of common data sets by the research community
  - Approaches benchmarking
- When incorporating the geometric description of no-fit-polygons and inner-fit-polygons, increase the research in the field
  - No need to implement or use complex geometric libraries, for research purposes
- Allow an accurate description of solutions for each instance
  - No more need to digitalise layouts from papers

Which problem characteristics were considered?

- Only the widely considered in published literature or in the front-line of the future developments:
  - Pieces with several components
  - Polygons
  - Rotations and symmetries
  - Several boards
- But new developments can be incorporated:
  - Arcs
  - …..
- While others do not seem compatible with this format:
  - 3D irregular packing

General structure

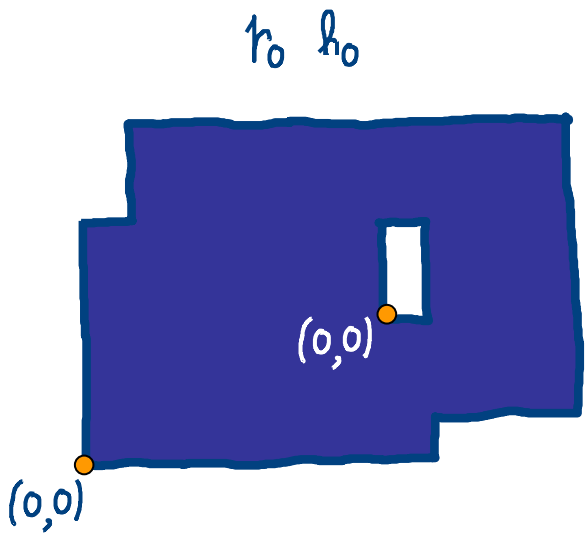
```
<nesting>
    <name>Example</name>
    <author>Jose F. Oliveira</author>
    <date>17/03/05</date>
    <description>
        An example with one board and two pieces. The coordinates origin is the
        bottom-left corner.
    </description>
    <verticesOrientation>clockwise</verticesOrientation>
    <problem></problem>
    <nfps></nfps>
    <ifps></ifps>
    <polygons></polygons>
    <sequences></sequences>
    <solutions></solutions>
</nesting>
```

The <problem> section

```
<problem>
    <orientation>
        <interval minAngle="0.0" maxAngle="10.0"/>
        <interval minAngle="100.0" maxAngle="120.0"/>
        <enumeration angle="90.0"/>
        <enumeration angle="180.0"/>
        <enumeration angle="270.0"/>
        <reflection mirror="x"/>
    </orientation>
    <boards></boards>
    <lot></lot>
</problem>
```

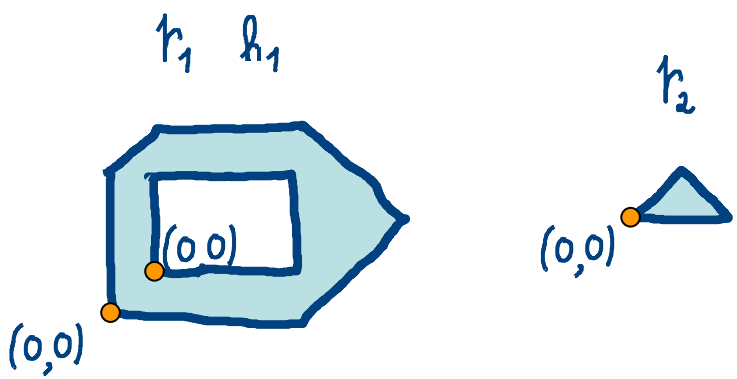
The <boards> sub-section

```
<problem>
    <orientation></orientation>
    <boards>
        <piece id="board1" quantity="1">
                <component type="0" idPolygon="poly0" xOffset="0.0" yOffset="0.0"/>
                <component type="-1" idPolygon="hole0" xOffset="6.0" yOffset="-3.0"/>
        </piece>
    </boards>
    <lot></lot>
</problem>
```



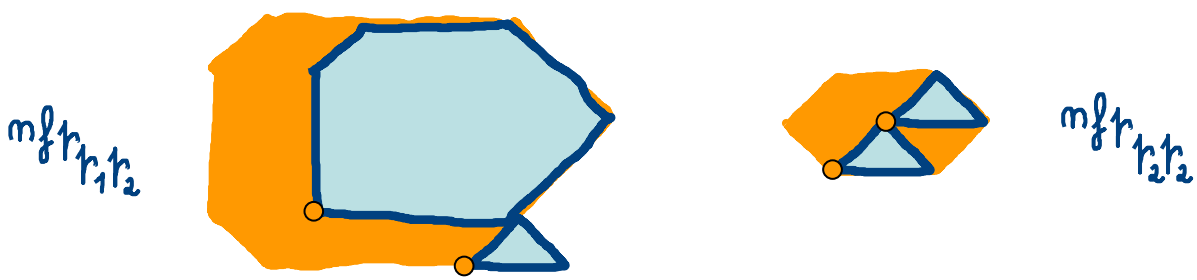
The <lot> sub-section

```
<problem>
   <orientation></orientation>
   <boards></boards>
   <lot>
      <piece id="piece1" quantity="1">
            <component type="0" idPolygon="poly1" xOffset="0.0" yOffset="0.0"/>
            <component type="-1" idPolygon="hole1" xOffset="1.0" yOffset="-1.0"/>
      </piece>
      <piece id="piece2" quantity="2">
            <component type="0" idPolygon="poly2" xOffset="0.0" yOffset="0.0"/>
      </piece>
   </lot>
</problem>
```



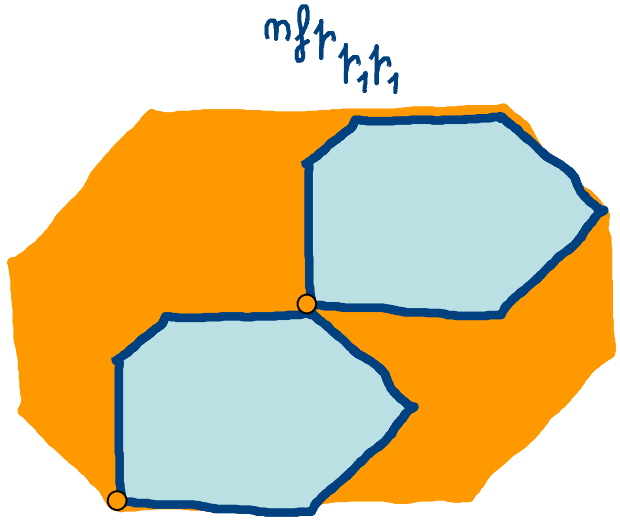
The <nfps> section

```
<nfps>
    <nfp>
        <staticPolygon idPolygon="poly1" angle="0.0" mirror="none"/>
        <orbitingPolygon idPolygon="poly2" angle="0.0" mirror="none"/>
        <resultingPolygon idPolygon="nfp_p1_p2"/>
    </nfp>
    <nfp>
        <staticPolygon idPolygon="poly2" angle="0.0" mirror="none"/>
        <orbitingPolygon idPolygon="poly2" angle="0.0" mirror="none"/>
        <resultingPolygon idPolygon="nfp_p2_p2"/>
    </nfp>
    [...]
</nfps>
```



The <nfps> section

```
<nfps>
    [...]
    <nfp>
        <staticPolygon idPolygon="poly1" angle="0.0" mirror="none"/>
        <orbitingPolygon idPolygon="poly1" angle="0.0" mirror="none"/>
        <resultingPolygon idPolygon="nfp_p1_p1"/>
    </nfp>
    [...]
</nfps>
```

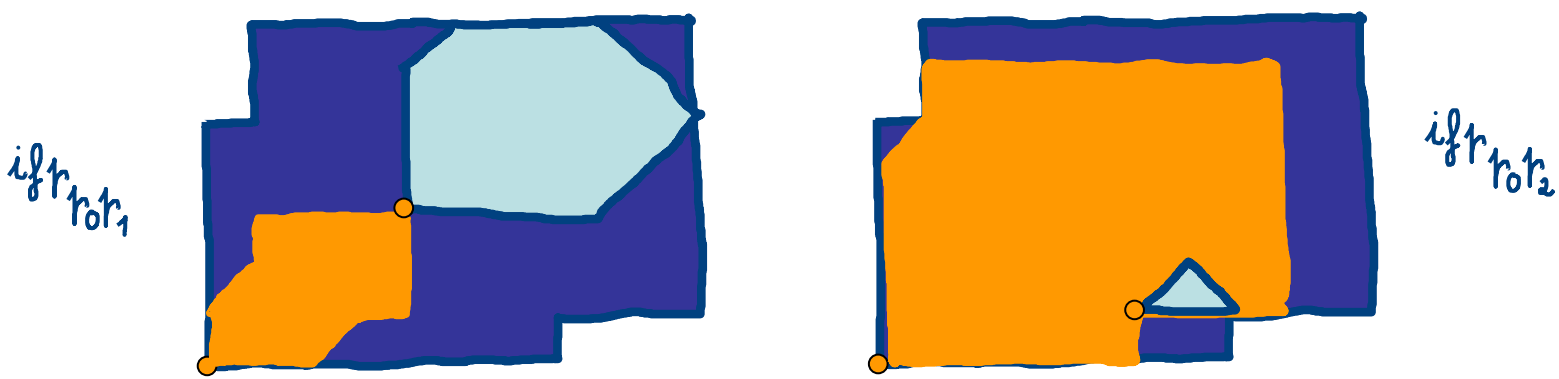


The <nfps> section

```
<nfps>
    [...]
    <nfp>
        <staticPolygon idPolygon="hole0" angle="0.0" mirror="none"/>
        <orbitingPolygon idPolygon="poly1" angle="0.0" mirror="none"/>
        <resultingPolygon idPolygon="nfp_h0_p1"/>
    </nfp>
    <nfp>
        <staticPolygon idPolygon="hole0" angle="0.0" mirror="none"/>
        <orbitingPolygon idPolygon="poly2" angle="0.0" mirror="none"/>
        <resultingPolygon idPolygon="nfp_ho_p2"/>
    </nfp>
</nfps>
```

The <ifps> section

```
<ifps>
    <nfp>
        <staticPolygon idPolygon="poly0" angle="0.0" mirror="none"/>
        <orbitingPolygon idPolygon="poly1" angle="0.0" mirror="none"/>
        <resultingPolygon idPolygon="ifp_p0_p1"/>
    </nfp>
    <nfp>
        <staticPolygon idPolygon="poly0" angle="0.0" mirror="none"/>
        <orbitingPolygon idPolygon="poly2" angle="0.0" mirror="none"/>
        <resultingPolygon idPolygon="ifp_p0_p2"/>
    </nfp>
    [...]
</ifps>
```

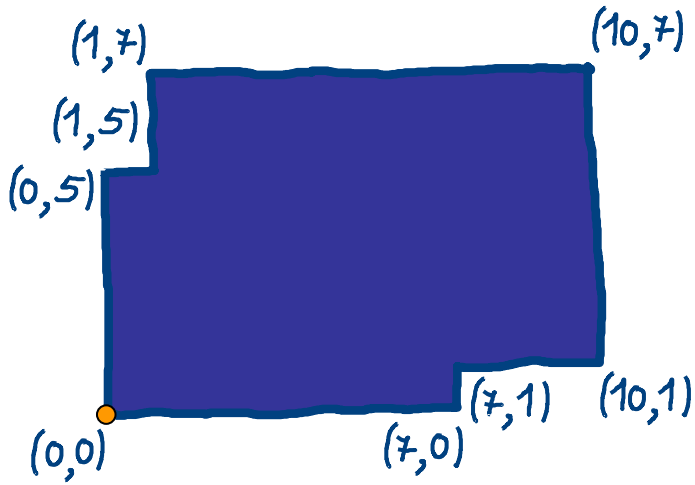


The <ifps> section

```
<ifps>
   [...]
   <nfp>
      <staticPolygon idPolygon="hole1" angle="0.0" mirror="none"/>
      <orbitingPolygon idPolygon="poly2" angle="0.0" mirror="none"/>
      <resultingPolygon idPolygon="ifp_h1_p2"/>
   </nfp>
   <nfp>
      <staticPolygon idPolygon="hole1" angle="0.0" mirror="none"/>
      <orbitingPolygon idPolygon="hole0" angle="0.0" mirror="none"/>
      <resultingPolygon idPolygon="ifp_h1_h0"/>
   </nfp>
</ifps>
```

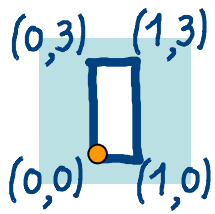
The <polygons> section

```
<polygons>
   <polygon id="poly0" nVertices="8">
      <vertices>
            <vertex x="0.0" y="0.0"/>
            <vertex x="0.0" y="5.0"/>
            <vertex x="1.0" y="5.0"/>
            <vertex x="1.0" y="7.0"/>
            <vertex x="10.0" y="7.0"/>
            <vertex x="10.0" y="1.0"/>
            <vertex x="7.0" y="1.0"/>
            <vertex x="7.0" y="0.0"/>
      </vertices>
      <xMin>0.0</xMin>
      <xMax>10.0</xMax>
      <yMin>0.0</yMin>
      <yMax>7.0</yMax>
      <perimeter>34.0</perimeter>
      <area>65.0</area>
      <idConvexHullPolygon>convhull0</idConvexHullPolygon>
   </polygon>
   [...]
```



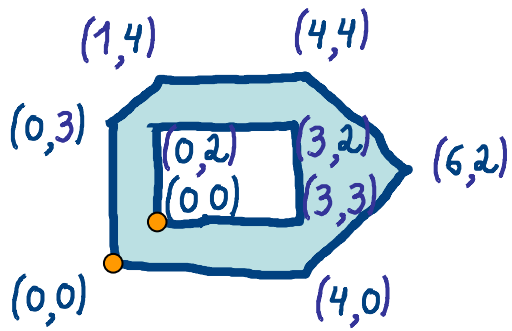
The <polygons> section

```
<polygon id="convhull0" nVertices="4">
    <vertices>
            <vertex x="0.0" y="0.0"/>
            <vertex x="0.0" y="7.0"/>
            <vertex x="10.0" y="7.0"/>
            <vertex x="10.0" y="0.0"/>
    </vertices>
</polygon>
<polygon id="hole0" nVertices="4">
    <vertices>
            <vertex x="0.0" y="0.0"/>
            <vertex x="0.0" y="2.0"/>
            <vertex x="1.0" y="2.0"/>
            <vertex x="1.0" y="0.0"/>
    </vertices>
    <xMin>0.0</xMin>
    <xMax>1.0</xMax>
    <yMin>0.0</yMin>
    <yMax>2.0</yMax>
    <perimeter>6.0</perimeter>
    <area>2.0</area>
</polygon>
```



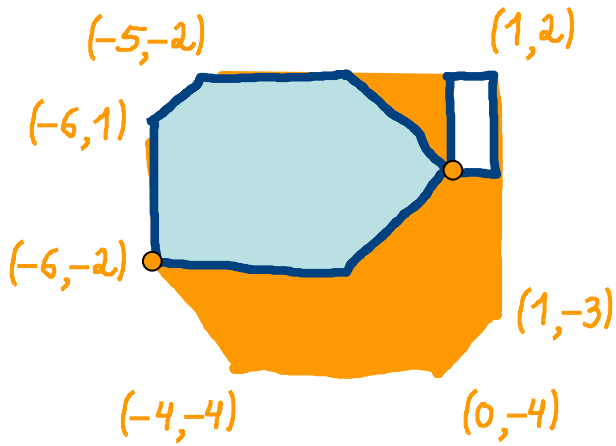
The <polygons> section

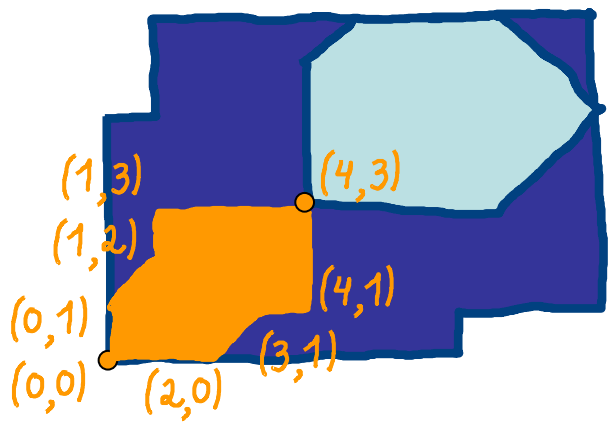
```
<polygon id="poly1" nVertices="6">
    <vertices>
        <vertex x="0.0" y="0.0"/>
        <vertex x="0.0" y="3.0"/>
        <vertex x="1.0" y="4.0"/>
        <vertex x="4.0" y="4.0"/>
        <vertex x="6.0" y="2.0"/>
        <vertex x="4.0" y="0.0"/>
    </vertices>
</polygon>
<polygon id="hole1" nVertices="4">
    <vertices>
        <vertex x="0.0" y="0.0"/>
        <vertex x="0.0" y="2.0"/>
        <vertex x="3.0" y="2.0"/>
        <vertex x="3.0" y="0.0"/>
    </vertices>
</polygon>
```



The <polygons> section

```
<polygon id="nfp_h0_p1" nVertices="7">
    <vertices>
            <vertex x="-6.0" y="-2.0"/>
            <vertex x="-6.0" y="1.0"/>
            <vertex x="-5.0" y="2.0"/>
            <vertex x="1.0" y="2.0"/>
            <vertex x="1.0" y="-3.0"/>
            <vertex x="0.0" y="-4.0"/>
            <vertex x="-4.0" y="-4.0"/>
    </vertices>
</polygon>
<polygon id="ifp_h0_p2" nVertices="6">
    <vertices>
            <vertex x="-2.0" y="0.0"/>
            <vertex x="-2.0" y="2.0"/>
            <vertex x="1.0" y="2.0"/>
            <vertex x="1.0" y="0.0"/>
            <vertex x="0.0" y="-1.0"/>
            <vertex x="-1.0" y="-1.0"/>
    </vertices>
</polygon>
```



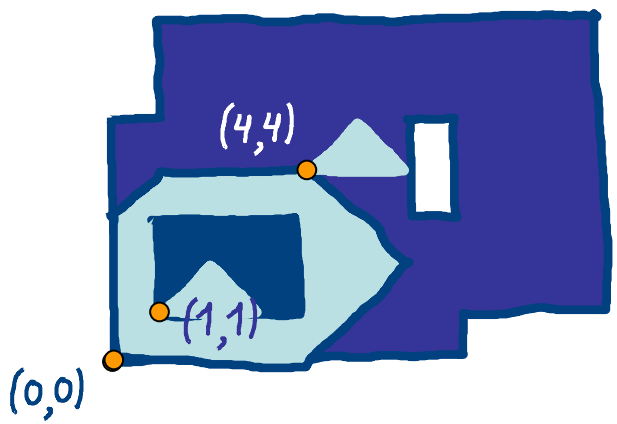


The <sequences> section

```
<sequences>
    <sequence>
        <description>Increasing Width</description>
        <piece>"piece2"</piece>
        <piece>"piece2"</piece>
        <piece>"piece1"</piece>
    </sequence>
</sequences>
```

The <solutions> section

```
<solutions>
    <solution>
        <placement idBoard="board1" idPiece="piece1" x="0.0" y="0.0" angle="0.0"
                mirror="none"/>
        <placement idBoard="board1" idPiece="piece2" x="1.0" y="1.0" angle="0.0"
                mirror="none"/>
        <placement idBoard="board1" idPiece="piece2" x="4.0" y="0.0" angle="0.0"
                mirror="none"/>
    </solution>
</solutions>
```



What can be done with data under this format?

- Post new problem instances
- Get no-fit-polygons and inner-fit-polygons descriptions
- Keep track of up-to-date best-solutions for instances
- Add new characteristics (not change existing ones) to the format