Refactoring the “As Specified” Decision model

We’ll discuss how the original model can be refactored to make it simpler and we’ll also discuss how a couple of enhancements might affect the model.
Below are each of the rules represented as decision tables (using the natural language view).

### Hold Rules

A ship's hold contains remainders of cargo if the residual cargo measurement is higher than 0.5 mg dry weight per cm².

The hold of a ship must be considered clean if the hold does not contain remainders of cargo.

<table>
<thead>
<tr>
<th>Conditions</th>
<th>1</th>
<th>2</th>
<th>3</th>
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<tbody>
<tr>
<td>What is the residual cargo measurement in the hold?</td>
<td></td>
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<tr>
<td>Was radioactivity detected in the hold?</td>
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<table>
<thead>
<tr>
<th>Actions</th>
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<tbody>
<tr>
<td>Post Message(s)</td>
</tr>
<tr>
<td>The hold is considered clean</td>
</tr>
<tr>
<td>The hold has no remainders of cargo</td>
</tr>
<tr>
<td>The hold is not considered clean</td>
</tr>
<tr>
<td>The hold has remainders of cargo</td>
</tr>
</tbody>
</table>

What if there are new reasons why the ship might have remainders? Where should we model that? e.g. radioactive. Additional factors could be added easily.

### Size Rules

A ship must be categorized as small if the total length of the ship is less than 80 meters.

A ship must be categorized as large if the total length of the ship is at least 80 meters.

NOTE: We should consider the possibility of any attribute being null.

What if there is an overlap between small and large? Suppose the rules said small was under 80 but large was over 60? What size is a ship of length 70?
Fortunately Corticon can detect this situation using its ambiguity checker.

We might decide to resolve it this way and then we’d need to accommodate ‘medium’ in the safety rules below.

**Safety Rules**

A **ship** only meets the safety requirements for large unloaded ships if the **ship** complies with all of the following:
- the **ship** is categorized as large
- the **hold** of the **ship** is clean
- the **hold** of the **ship** is double hulled.

A **ship** only meets the safety requirements for small unloaded ships if the **ship** complies with all of the following:
- the **ship** is categorized as small
- the **hold** of the **ship** is clean

A **ship** only meets the safety requirements for unloaded ships if the **ship** complies with at least one of the following:
- the **ship** meets the safety requirements for small unloaded ships
- the **ship** meets the safety requirements for large unloaded ships.

Incidentally Corticon can compress this by merging rules 2 and 4 since their outcome is the same:
Registry
A ship's certificate of registry must be considered valid if the date up to which the registration is valid of the certificate of registry is after the current date.

Inspection
A ship must comply with the requirements of the Inspection for unloaded ships if the ship complies with all of the following:
- the ship meets the safety requirements for unloaded ships
- the ship has a certificate of registry that is valid.

An unloaded ship may only enter a Dutch port if the ship complies with the requirements of the Inspection for unloaded ships.

Rule Sheet Dependency
Attribute Dependency

You can see in the refactored model which attributes are not used (black with no exit line)
Test Cases

A Ship that may enter a Dutch port

Notice that the rule statements have been slightly changed to read as statements of fact about the ship being considered along with an explanation. The notes in [ ] indicate the rule sheet and rule that produced the message. These messages become the decision audit trail. In some cases actual values have been inserted.
A Ship that may not enter a Dutch port

- **Ship (14)**
  - notDoubleHulled [false]
  - hasValidCertificateOfRegistry [false]
  - isDoubleHulled [false]
  - meetsInspectionRequirements [false]
  - meetsSafetyRequirementsOverall [false]
  - size [large]
  - totalLength [81.000000]
  - certificateOfRegistry (CertificateOfRegistry) [14]
    - expiryDate [10/1/2014 08:00:00]

- **Hold (Hold) (14)**
  - hasRemaundersOfCargo [true]
  - isClean [false]
  - residualCargoMeasurement [0.600000]

**Warning (Hold, 2)** The ship’s hold contains remainders of cargo since the residual cargo measurement is higher than 0.5 mg dry weight per c...

**Warning (Hold, 2)** The hold of the ship is considered NOT clean since the hold does contain remainders of cargo

**Info (Size, 2)** The ship is categorized as large since the total length of the ship (81.000000) is at least 80 meters

**Warning (Safety, 4)** The hold is not clean so does not meet the safety requirements

**Warning (Safety, 5)** The ship is not double hulled so does not meet the safety requirements (for large ships)

**Warning (Registry, 2)** The ship’s certificate of registry is considered NOT valid since the date (10/1/2014 08:00:00) up to which the registration...

**Warning (Inspection, 2)** The ship does not meet inspection requirements since it does not meet the safety requirement

**Violation (Inspection, 2)** The ship may not enter a Dutch port since it does not meet the inspection requirements

**Warning (Inspection, 3)** The ship does not meet inspection requirements since it does not have a valid certificate of registry
Ship [1] (data is missing)
  certificateOfRegistry (CertificateOfRegistry) [1]
  hold (h-loc) [1]
Ship [2] (data is missing)
  hold (h-loc) [2]
  totalLength [90.000000]
  certificateOfRegistry (CertificateOfRegistry) [2]

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<tr>
<td>Severity</td>
<td>Message</td>
<td>Entity</td>
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</tr>
<tr>
<td>Warning</td>
<td>[inspection,6] Ship length is missing</td>
<td>Ship[1]</td>
<td></td>
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</tr>
<tr>
<td>Warning</td>
<td>[inspection,7] Ship residual cargo measurement is missing</td>
<td>Ship[1]</td>
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</tr>
<tr>
<td>Warning</td>
<td>[inspection,8] Ship certificate date is missing</td>
<td>Ship[1]</td>
<td></td>
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</tr>
<tr>
<td>Warning</td>
<td>[Port_Clearance,3] It cannot be determined whether the ship may enter a Dutch port.</td>
<td>Ship[1]</td>
<td></td>
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<tr>
<td>Warning</td>
<td>[inspection,9] Ship isDouble Hulled is missing (required when ship is large)</td>
<td>Ship[2]</td>
<td></td>
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</tr>
<tr>
<td>Warning</td>
<td>[inspection,10] Ship certificate date is missing</td>
<td>Ship[2]</td>
<td></td>
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</tr>
<tr>
<td>Warning</td>
<td>[Port_Clearance,3] It cannot be determined whether the ship may enter a Dutch port.</td>
<td>Ship[2]</td>
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<tr>
<td>Rule</td>
<td>Description</td>
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<td>------</td>
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</tr>
<tr>
<td><strong>Clean</strong></td>
<td>The hold of a ship must be considered clean if the hold does not contain remainders of cargo.</td>
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</tr>
<tr>
<td><strong>Clearance Dutch Port</strong></td>
<td>An unloaded ship may only enter a Dutch port if the ship complies with the requirements of the Inspection for unloaded ships.</td>
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</tr>
</tbody>
</table>
| **Inspection requirements** | A ship must comply with the requirements of the Inspection for unloaded ships if the ship complies with all of the following:  
  - the ship meets the safety requirements for unloaded ships  
  - the ship has a certificate of registry that is valid. |
| **Large ship** | A ship must be categorized as large if the total length of the ship is at least 80 meters. |
| **Remainders of cargo** | A ship’s hold contains remainders of cargo if the residual cargo measurement is higher than 0.5 mg dry weight per cm². |
| **Safety requirements** | A ship only meets the safety requirements for large unloaded ships if the ship complies with all of the following:  
  - the ship is categorized as large  
  - the hold of the ship is clean  
  - the hold of the ship is double hulled. |
| **Safety requirements small** | A ship only meets the safety requirements for small unloaded ships if the ship complies with all of the following:  
  - the ship is categorized as small  
  - the hold of the ship is clean. |
| **Small ship** | A ship must be categorized as small if the total length of the ship is less than 80 meters. |
| **Valid certificate of registry** | A ship’s certificate of registry must be considered valid if the date up to which the registration is valid of the certificate of registry is after the current date. |