

## Tutorial - Semantic Web n° 1

## Semantic Web

**Exercise 1 *Semantics in PL***

Let  $\alpha = (p \vee q) \wedge (\neg p \wedge \neg q)$  be a formula :

1. Is  $\alpha$  consistent ? Is  $\alpha$  valide ? Justify your answers.
2. Does  $\{p \vee q, \neg p\}$  imply  $q$  ? Why ?

**Exercise 2****Horn rule reasoning**

Consider the Horn rule base as follows :

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- R<sub>1</sub> : if boat **and** sport **and** sail **then** sailboat.
  - R<sub>2</sub> : if boat **and** pleasure **and** sail **then** sailboat.
  - R<sub>3</sub> : if sailboat **and** no\_triangular\_latin\_sail **then** gaff\_rig.
  - R<sub>4</sub> : if keel **then** keelboat.
  - R<sub>5</sub> : if no\_keel **and** sailboat **then** sailingDinghy **and** portable.
  - R<sub>6</sub> : if habitable **and** sailboat **then** sailboat\_cruise **and** no\_portable.
  - R<sub>7</sub> : if no\_longer\_than\_8  
          **then** no\_longer\_than\_13 **and** no\_longer\_than\_10.
  - R<sub>8</sub> : if keelboat **then** no\_portable.
  - R<sub>9</sub> : if longer\_than\_13 **then** longer\_than\_10.
  - R<sub>10</sub> : if keelboat **and** no\_keelboat\_regatta **then** keelboat\_cruise.
  - R<sub>11</sub> : if keelboat **and** sport **then** keelboat\_sport.
  - R<sub>12</sub> : if longer\_than\_10 **then** longer\_than\_8.
  - R<sub>13</sub> : if keelboat **and** no\_habitable **then** keelboat\_regatta.
  - R<sub>14</sub> : if no\_portable **and** no\_habitable **and** sailboat **then** sailboat\_walking.
  - R<sub>15</sub> : if keelboat\_cruise **then** sailboat\_cruise.
  - R<sub>16</sub> : if sailboat\_cruise **and** longer\_than\_8 **and** no\_longer\_than\_10  
          **then** cruise\_semi\_offshore.
  - R<sub>17</sub> : if sailboat\_cruise **and** longer\_than\_10  
          **then** racing\_can **and** cruise\_offshore.
  - R<sub>18</sub> : if sailboat\_cruise **and** no\_longer\_than\_8 **then** sailboat\_cruise\_coastal.
  - R<sub>19</sub> : if sailboat\_cruise **and** nombre\_of\_shells\_larger\_than\_1 **then** sailboat\_multishell.
  - R<sub>20</sub> : if longer\_than\_13 **and** racing\_can **then** transoceanic\_race.
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FIGURE 1 – Horn rule base

**Questions on Inference by Forward Chaining**

Suppose we have the following facts in the initial FB (fact base) :

$FB = \{\text{longer\_than\_13, habitable, no\_keel, boat, sport, sail}\}$

1. Apply the algorithm *ForwardChaining* by valuing iteratively the rule base above over the initial fact base, indicating in each iteration the releasable rules, the new facts deduced, and count the total number of calling the match operator for associating the condition and FB. What can you remark?
2. Manually simulate the construction of inverse index.
3. By this index, please apply the ForwardChaining with propagation of facts, while indicating precisely the order of which the facts are propagated, also the updates and the releasable rules applied in each propagation of facts. Please compare the total number of calls of the match operator with that in the question 1.

### Exercise 3

#### Questions on Backward Chaining

1. We assume that no fact is demandable. Construct the AND-OR tree developed by the algorithm *BackwardChaining* applied over the initial goal *transoceanic\_race* and the rule base in figure 1 from the following initial facts  
 $BF = \{\text{longer\_than\_13}, \text{habitable}, \text{no\_keel}, \text{boat}, \text{sport}, \text{sail}\}$
2. We suppose that all the facts are demandable. Construct the AND-OR tree developed by the *BackwardChaining* algorithm over the initial goal *sailboat\_cruise* from the initial fact base :  
 $BF = \{\text{boat}, \text{sail}\}$  while :
  - (a) all the users' answers are positive
  - (b) all the answers are negative
  - (c) the answers are alternatively positive and negative