

KRR: Unit 4 Formative Activities

by Maria Ingold

Title: Introduction to Logic Programming

Prolog can be used to test the questions included in Unit 2.

For example, to test exercise 1 carry out the following steps.

- Surf to <https://swi-prolog.org>
- Click on “try swi-prolog online”.
- On the SWISH page click on notebook.
- Click on Query.
- In the ‘query’ box enter “member(c, [a,b,c,2,3,4])”.
- Click the go (>) button – it should give the answer ‘true’ (I.e., c is a member of the set).
- How many of the questions in exercise 1 can you check in this way?

1. Given the following sets:

$$\begin{array}{ll} A = \{a, b, c, 2, 3, 4\} & E = \{a, b, \{c\}\} \\ B = \{a, b\} & F = \emptyset \\ C = \{c, 2\} & G = \{\{a, b\}, \{c, 2\}\} \\ D = \{b, c\} & \end{array}$$

classify each of the following statements as true or false

$$\begin{array}{lll} \text{(a)} & c \in A & \text{(g)} & D \subset A & \text{(m)} & B \subseteq G \\ \text{(b)} & c \in F & \text{(h)} & A \subseteq C & \text{(n)} & \{B\} \subseteq G \\ \text{(c)} & c \in E & \text{(i)} & D \subseteq E & \text{(o)} & D \subseteq G \\ \text{(d)} & \{c\} \in E & \text{(j)} & F \subseteq A & \text{(p)} & \{D\} \subseteq G \\ \text{(e)} & \{c\} \in C & \text{(k)} & E \subseteq F & \text{(q)} & G \subseteq A \\ \text{(f)} & B \subseteq A & \text{(l)} & B \in G & \text{(r)} & \{\{c\}\} \subseteq E \end{array}$$

- a) T
- b) F
- c) F
- d) T
- e) F
- f) T
- g) T
- h) F
- i) F
- j) T

- k) F
- l) T. B is a member of G
- m) F. B is a subset of A, not G
- n) T.
- o) F
- p) F
- q) F
- r) T. The member $\{c\}$ of set $\{\{c\}\}$ is subset of $\{a,b,\{c\}\}$

- a) T member(c , $[a,b,c,2,3,4]$)
- b) F member(c , $[\]$).
- c) F member(c , $[a,b,[c]]$).
- d) T member($[c]$, $[a,b,[c]]$).
- e) F member($[c]$, $[c,2]$).
- f) T subset($[a,b]$, $[a,b,c,2,3,4]$).
- g) ?? proper subset
- h) F subset($[a,b,c,2,3,4]$, $[c,2]$).
- i) F subset($[b,c]$, $[a,b,\{c\}]$).
- j) T subset($[\]$, $[a,b,c,2,3,4]$).
- k) F subset($[a,b,[c]]$, $[\]$).
- l) T member($[a,b]$, $[[a,b],[c,2]]$).
- m) F subset($[a,b]$, $[[a,b],[c,2]]$).
- n) T subset($[[a,b]]$, $[[a,b],[c,2]]$).
- o) F subset($[b,c]$, $[[a,b],[c,2]]$).
- p) F subset($[[b,c]]$, $[[a,b],[c,2]]$).
- q) F subset($[[a,b],[c,2]]$, $[a,b,c,2,3,4]$).
- r) T subset($[[c]]$, $[a,b,[c]]$).

Extra assignment: Code a Proper Subset

As another example, we state the definition of 'proper subset' and give both formal and informal proofs of a theorem containing this predicate.

$$(7-56) \quad (\forall X, Y)(X \subset Y \leftrightarrow (X \subseteq Y \ \& \ X \neq Y))$$

For all x and y, x is a proper subset of y iff ((x is a subset of y) and (x does not equal y))

Trying to code a proper subset in Prolog. Lots of mistakes learning how to.

```
/* D is a proper subset of A
* A = {a,b,c,2,3,4}
* D = {b,c}
*
* Use: propersubset([b,c], [a,b,c,2,3,4]).
* The result should be true.
*
* Use: propersubset([a,b,c,2,3,4], [a,b,c,2,3,4]).
* The result should be false.
*
* Rules of a proper subset:
* For all x and y, x is a proper subset of y iff ((x is a subset of y) and (x does not equal y))
*/
propersubset(X, Y) :-
    write("X: "), write(X), nl, write("Y: "), write(Y), nl, /* Variables are upper case. Remember the comma if not at the end */

%      Is it a subset?
%      subset(X, Y),          /* Yep, it is a subset */
%      nl, write(subset(X, Y)). /* This doesn't write true, so can't use as a function with a BOOLEAN return */

%      Is it not equal?
%      same_length(X, Y).    /* Not sufficient, only tests length */
%      =(X, Y).              /* Assign? This does not mean equality */
%      [a,b,c,2,3,4] == [a,b,c,2,3,4]. /* Equality test. YES! True! */
%      X == Y.               /* Are the two terms equal? What about NOT equal? */
%      [a,b,c,2,3,4] \== [a,b,c,2,3,4]. /* This returns False! */
%      X \== Y.              /* Are two terms not equal */

%      Now AND them together.
%      subset(X, Y) and (X \== Y). /* NOPE */
%      subset(X, Y)* (X \== Y). /* * is a logical AND operator. NOPE that website was wrong.*/
%      (subset(X, Y), (X \== Y)). /* Another website says this is the format for logical AND. BINGO!*/
```