

Laurea Magistrale in INFORMATICA

Principi di Linguaggi di Programmazione

Paradigmi

prof. M. Bellia
Appello III - June 4th, 2013

(Timing: 2 hours – Grading: (pts n-m) is the score range to be obtained in each exercise)

Exercise 1. (pts 5 - 9) Let H be the set of strings on the alphabet $\{a,b,c,d\}$. Use Prolog to define:

- (a) (pts 1) A concrete representation for the values of H
- (b) (pts 4) A predicate $inc/2(u,v)$ which holds whenever u and v are strings of H and u includes v .
- (c) (pts 4) A predicate $split/4(u,ub,v,ue)$ which holds whenever u , ub , v , and ue are strings of H and $u=ub.v.ue$, i.e. u is the concatenation of ub , v , ue .

Exercise 2. (pts. 5 - 10) Let $IRel$ be an Abstract Data Type for immutable binary, non-empty, relations on two generic types. These relations have the following public operations:

- $newIRel(u,v)$: returns a new $IRel$ that contains the only pair (u,v) ;
- $add(u,v,r)$: returns a new $IRel$ r' that may differ from r for the pair (u,v) , provided that u and v have the right types for r ;
- $get2(u,r)$: returns the list that contains all and only the v such that (u,v) is a pair of r .

Use Caml to define:

- (a) (pts 2) An API for $IRel$
- (b) (pts 8) An ADT for $IRel$ such that:
 1. values are represented by a list of distinct pairs;
 2. it includes a private operation $contain(u,v,r)$ that:
 - i. returns true iff the relation r contains the pair (u,v) ;
 - ii. it is defined by using the iterative programming methodology

Exercise 3. (punti 6 - 11) Let $MRel$ be a Java Class for an ADT of non-empty relations, like in exercise 2, but now, mutable.

- (a) (pts 4) Define a Java class $MRelS$ that extends $MRel$ by adding the new public operation $size()$ that returns the number of distinct pairs of the relation.
- (b) (pts 7) Define a class $MRelR$ that extends $MRelS$ by adding a new public operation $remove(u,v)$ that modifies the relation by removing the pair (u,v) , if any.