

# Purely Functional Algorithm Specification

## Exercises Day 5

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[homepages.cwi.nl/~jve/courses/12/esslli12/](http://homepages.cwi.nl/~jve/courses/12/esslli12/)

```
module Exerc5

where

import List
import While
import Assert
import Reasoning (update, updates)
import MatchingDivision
```

## Termination of the Stable Marriage Algorithm

**Exercise 1** Show that if there are equal numbers of men and women, the algorithm always terminates. Hint: analyze what happens to the preference lists of the men. Observe that no man proposes to the same woman twice.

## Testing the Algorithm

**Exercise 2** Someone proposed to test the algorithm by interchanging the preference tables of the men and women, and checking whether the result would be the same match (but with men and women reversed). Good idea or not? Why?

## Reflection on Gale-Shapley

**Exercise 3** Is the Gale-Shapley algorithm more favourable for the men, or for the women? Or doesn't it matter? Motivate your answer.

## Implementing a Variation

**Exercise 4** The task in the **stable roommate problem** is like that in the stable marriage problem: find a stable matching of  $2n$  students. Unlike the stable marriage case, the set of students is not broken up into male and female. Any person can prefer anyone in the same set.

Look up the algorithm given for this in [1] or on wikipedia ([http://en.wikipedia.org/wiki/Stable\\_roommates\\_problem](http://en.wikipedia.org/wiki/Stable_roommates_problem)), implement it, and next develop an assertive version for it.

## Reflections on Fairness

**Exercise 5** Use this example to analyze the notion of fairness. Give three definitions of fairness, to match the three divisions mentioned in the tale. Argue that according to your first definition, the division ‘each an equal share of 4 coins’ is fair, that according to the second definition, ‘5 coins for Shyam and 3 for Ram’ is fair, and that according to the third definition, the solution they finally arrived at is fair. Draw a moral from this.

## References

- [1] Robert W. Irving. An efficient algorithm for the “stable roommates” problem. *Journal of Algorithms*, 6(4):577–595, 1985.