

Package matchingMarkets

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daa

Deferred Acceptance Algorithm

Description

Finds the student (men) optimal matching in the **college admissions** (**stable marriage**) problem. Uses the Gale-Shapley (1962) Deferred Acceptance Algorithm with student (male) offer based on given or randomly generated preferences.

Usage

```
daa(nStudents = ncol(s.prefs), nColleges = ncol(c.prefs),  
    nSlots = rep(1, nColleges), s.prefs = NULL,  
    c.prefs = NULL)
```

Arguments

nStudents	integer indicating the number of students (in the college admissions problem) or men (in the stable marriage problem) in the market. Defaults to <code>ncol(s.prefs)</code> .
nColleges	integer indicating the number of colleges (in the college admissions problem) or women (in the stable marriage problem) in the market. Defaults to <code>ncol(c.prefs)</code> .
nSlots	vector of length <code>nColleges</code> indicating the number of places (i.e. quota) of each college. Defaults to <code>rep(1, nColleges)</code> for the marriage problem.
s.prefs	matrix of dimension <code>nColleges</code> x <code>nStudents</code> with the <code>i</code> th column containing student <code>i</code> 's ranking over colleges in decreasing order of preference (i.e. most preferred first).
c.prefs	matrix of dimension <code>nStudents</code> x <code>nColleges</code> with the <code>j</code> th column containing college <code>j</code> 's ranking over students in decreasing order of preference (i.e. most preferred first).

Value

'daa' returns a list with the following items.

s.prefs	students' preference matrix.
c.prefs	colleges' preference matrix.
iterations	number of iterations required to find the stable matching.
matches	identifier of students (men) assigned to colleges (women).
match.mat	matching matrix of dimension nStudents x nColleges.
singles	identifier of single/unmatched students (men).

Minimum required arguments

'daa' requires the following combination of arguments, subject to the matching problem.

nStudents, nColleges Marriage problem with random preferences.

s.prefs, c.prefs Marriage problem with given preferences.

nStudents, nSlots College admissions problem with random preferences.

s.prefs, c.prefs, nSlots College admissions problem with given preferences.

Author(s)

Thilo Klein <thilo@klein.co.uk>

References

Gale, D. and Shapley, L.S. (1962). College admissions and the stability of marriage. The American Mathematical Monthly, 69(1):9–15.

Examples

```
## Marriage problem (3 men, 2 women) with random preferences:
daa(nStudents=3, nColleges=2)
```

```
## Marriage problem (3 men, 2 women) with given preferences:
s.prefs <- matrix(c(1,2, 1,2, 1,2), 2,3)
c.prefs <- matrix(c(1,2,3, 1,2,3), 3,2)
daa(s.prefs=s.prefs, c.prefs=c.prefs)
```

```
## College admission problem (7 students, 2 colleges
## with 3 slots each) with random preferences:
daa(nStudents=7, nSlots=c(3,3))
```

```
## College admission problem (7 students, 2 colleges
## with 3 slots each) with given preferences:
s.prefs <- matrix(c(1,2, 1,2, 1,2, 1,2, 1,2, 1,2, 1,2), 2,7)
c.prefs <- matrix(c(1,2,3,4,5,6,7, 1,2,3,4,5,6,7), 7,2)
daa(s.prefs=s.prefs, c.prefs=c.prefs, nSlots=c(3,3))
```

plp

Partitioning Linear Programme

Description

Finds the stable matching in the **stable roommates problem** with transferable utility. Uses the Partitioning Linear Programme formulated in Quint (1991).

Usage

```
plp(V = NULL, N = NULL)
```

Arguments

N	number of players in the market
V	valuation matrix of dimension NxN that gives row-players valuation over column players (or vice versa)

Value

'plp' returns a list with the following items.

Assignment.matrix

upper triangular matrix of dimension NxN with entries of 1 for equilibrium pairs and 0 otherwise.

Equilibrium.groups

matrix that gives the N/2 equilibrium pairs and equilibrium partners' mutual valuations.

Author(s)

Thilo Klein <thilo@klein.co.uk>

References

Quint, T. (1991). Necessary and sufficient conditions for balancedness in partitioning games. *Mathematical Social Sciences*, 22(1):87–91.

Examples

```
## Roommate problem with 10 players, transferable utility and random preferences:
plp(N=10)

## Roommate problem with 10 players, transferable utility and given preferences:
V <- matrix(rep(1:10, 10), 10, 10)
plp(V=V)
```

ttc	<i>Top-Trading-Cycles Algorithm</i>
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Description

Finds the stable matching in the **house allocation problem** with existing tenants. Uses the Top-Trading-Cycles Algorithm proposed in Abdulkadiroglu and Sonmez (1999).

Usage

```
ttc(P = NULL, X = NULL)
```

Arguments

P	list of individuals' preference rankings over objects
X	2-column-matrix of objects ('obj') and their owners ('ind')

Value

'ttc' returns a 2-column matrix of the stable matching solution for the housing market problem based on the Top-Trading-Cycles algorithm.

Author(s)

Thilo Klein <thilo@klein.co.uk>

References

Abdulkadiroglu, A. and Sonmez, T. (1999). House Allocation with Existing Tenants. *Journal of Economic Theory*, 88(2):233–260.

Examples

```
## generate list of individuals preference rankings over objects
P <- list()
P[[1]] <- c(2,5,1,4,3) # individual 1
P[[2]] <- c(1,5,4,3,2) # individual 2
P[[3]] <- c(2,1,4,3,5) # individual 3
P[[4]] <- c(2,4,3,1,5) # individual 4
P[[5]] <- c(4,3,1,2,5); P # individual 5

## generate 2-column-matrix of objects (obj) and their owners (ind)
X <- data.frame(ind=1:5, obj=1:5); X

## find assignment based on TTC algorithm
ttc(P=P,X=X)
```

Index

daa, [1](#)

plp, [3](#)

ttc, [4](#)