

## README FILE for the MATLAB programs accompanying

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"Efficient Kidney Exchange: Coincidence of Wants in Markets with Compatibility-Based Preferences"

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### The "static" simulations are run through `threeway_sim_main_cplex.m`

This program requires:

MATLAB 7 (Release 13), CPLEX version 8 (`cplex80.dll` should be in the same folder as the other programs), **`findcyc4_new5.m`**, **`maxcardmatch_UNR_CPLEX2.m`**, **`createpatientDICH.m`**, **`maxcardmatch_4way_count_CPLEX2_mincyc.m`**, **`prmatch.m`**, **`GEDpriority_poly.m`**, **`cardmatching.m`**, **`GEDDecompose1.m`**, **`GEDHALL_sprank.m`**, **`GED1_new.m`**, **`recursivedepthfirst_new.m`**, **`recursedown_new.m`**, **`cardmatching.m`** `kidneymex.dll`, `milp_cplex.dll`, `ABOdist.txt`, `PRAdist.txt`, `livunrdonspousedist.txt`, `femalepatdist.txt`, `kidneyoutput.txt`

Boldface files are included in the package. CPLEX 8.0 with `cplex80.dll`, and MATLAB 7 (Release 13) require site licenses.

#### ***Some program inputs:***

`Maxsim` parameter sets the number of Monte Carlo repetitions for each population size. The array, `pops` are assigned the three population sizes used in simulations, 25, 50, and 100. The blood type CDF is given in `ABOdist.txt` for O, A, B and AB blood types in order. The PRA CDF is given in `PRAdist.txt` for low (5%), medium (45%) and high (90%) PRAs in order. The frequency of spouses among unrelated live donors is in `livunrdonspouse.txt`. The frequency of female patients is given in `femalepatdist.txt`

#### ***Program output:***

When the program is run a line by line output is generated for each generated market, for example

```
25 24 8 11 11 12 14 17 17 8 12 12 51
```

This output means that population size is 25, this is 24<sup>th</sup> market out of `maxsim` markets, 8 patients are matched in 2-way, 11 in 2&3-way, 11 in 2&3&4-way, and 12 in unrestricted exchanges.

When our formula is calculated according to the upper-bound 1 (see the paper for its description), the 2-way exchange upper-bound is 14, 2&3-way upper-bound is 17, 2&3&4-way upper-bound is 17.

When our formula is calculated according to the upper-bound 2 (see the paper for its description), the 2-way exchange upper-bound is 8, 2&3-way upper-bound is 12, 2&3&4-way upper-bound is 12.

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<sup>1</sup> All simulations require MATLAB 7 (Release 13) or higher versions, and ILOG/CPLEX 8.0 (may not work with higher versions without the `cplex80.dll` file, renaming the `cplexXY.dll` that comes with version X.Y as `cplex80.dll` may work in some versions, may not work in others).

In order to generate 25 incompatible pairs, the program had to randomly generate 51 pairs, 26 of them turned out to be compatible.

The final output file is

*threeway\_sim\_4.out*

where the averages and std deviations for the POPULATION are displayed in the above order. (THE POPULATION SIZE AND MARKET NUMBER ARE SKIPPED when averages and standard deviations are reported.) For example, for n=25, after 500 markets, we obtain

8.8600	11.2720	11.8240	11.9920	12.5000	14.6340	14.7020	9.8120	12.6600	12.8920	47.8140
3.4866	4.0003	3.9886	3.9536	3.6847	3.9552	3.9896	3.8599	4.3144	4.3417	6.7396

### **The "myopic dynamic" simulations are run through threeway\_sim\_main\_CPLEX\_dynamic.m**

This program needs MATLAB 7 (Release 13) or higher, CPLEX 8.0 (cplex80.dll should be in the same folder as the other programs), **createpatientDICH.m**, **milp\_cplex.dll**, **cplex80.dll**, **findcyc4\_new5.m**, **findcyc3\_new4.m**, **maxcardmatch\_UNR\_CPLEX2.m**

Boldface files are included in the package. CPLEX 8.0 with cplex80.dll, and Matlab 7 (Release 13) require site licenses.

The main inputs are like the previous program.

When the program is run in Matlab a typical in-line output looks like

25 2 10 12 12 12 15

where 25 is the maximum number of pairs arriving, 2nd out of *maxsim* number of markets generated, 10 pairs are matched with myopic dynamic 2-way exchange, 12 pairs are matched in myopic dynamic 2&3-way exchanges, 12 pairs are matched in myopic dynamic 2&3&4-way exchanges, 12 pairs are matched in myopic dynamic unrestricted exchanges. If the exchange was run after 25 pairs arrived at the pool 15 pairs would have been matched in unrestricted exchanges.

The final output file is

*threeway\_sim\_dyn2.out*

where the averages and standard deviations for the POPULATION are displayed in the above order. (THE POPULATION SIZE AND MARKET NUMBER ARE SKIPPED when averages and standard deviations are reported.) For example, for n=25, after 500 markets, we obtain

8.3040	9.5560	9.8660	9.9700	11.9920
3.1329	3.3861	3.4877	3.5268	3.9536

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