Instructions for MATLAB functions used in paper "Statistical Analysis of a Low Cost Method for Multiple Disease Prediction" by Bayati, Bhaskar, and Montanari

Convex Optimization

We used the minFunc package by Mark Shmidt to solve convex optimization problem for logistic regression with group lasso penalty. First note that the install instructions and the main website for minFunc is located at Mark Schmidt's website: https://www.cs.ubc.ca/~schmidtm/Software/minFunc.html. We repeat the necessary parts here for added conveniece.

First, download and unzip the files from here and then follow the steps below.

```
>> cd minFunc_2012        % Change to the unzipped directory
>> addpath(genpath(pwd)) % Add all sub-directories to the path
>> mexAll                % Compile mex files (not necessary on all
systems)
>> example_minFunc       % Run a demo trying to minimize the function
```

Running the example should produce the following output:

```
Result after 25 evaluations of limited-memory solvers on 2D rosenbrock:
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x1 = 0.0000, x2 = 0.0000 (starting point)
x1 = 1.0000, x2 = 1.0000 (optimal solution)
-------------------------------------
x1 = 0.8725, x2 = 0.7569 (minimize.m by C. Rasmussen)
x1 = 0.3654, x2 = 0.1230 (minFunc with steepest descent)
x1 = 0.4974, x2 = 0.2452 (minFunc with cyclic steepest descent)
x1 = 0.8756, x2 = 0.7661 (minFunc with spectral gradient descent)
x1 = 0.5840, x2 = 0.3169 (minFunc with Hessian-free Newton)
x1 = 0.7478, x2 = 0.5559 (minFunc with preconditioned Hessian-free
Newton)
x1 = 1.0010, x2 = 1.0020 (minFunc with conjugate gradient)
x1 = 0.7907, x2 = 0.6256 (minFunc with scaled conjugate gradient)
x1 = 0.9794, x2 = 0.9491 (minFunc with preconditioned conjugate
gradient)
x1 = 1.0000, x2 = 1.0000 (minFunc with limited-memory BFGS - default)
```

More examples. Mark Schmidt has written an extensive set of examples for the use of package here: https://www.cs.ubc.ca/~schmidtm/Software/minFunc/examples.html

Using MATLAB Integer Programming Toolbox

To solve the integer program, equation (6) of our paper, we used the function intlinprog from MATLAB optimization toolbox. Detailed instructions and examples for the use of function can be found here. In particular, to find the minimum of problem (6), if `ns` is the number of lab packages and `nu` is the number of all labs we need, then the following command should be used.

```
q = bintprog(c, intcon, A, b)
```

where `q` is a `ns` by `1` vector of indicator variables for the packages and `c` is a `ns` by `1` vector of costs for the packages. Then, `A` is a `ns` by `nu` matrix that encodes which labs appear in which packages and `b` is a `nu` by `1` vector with all values equal to `-1` since the inequality constraint in (6) should be casted as an upperbound.