

## Instructions

This document describes how to use the codes that were used to generate the random graph instances used in the paper ‘Optimization Bounds from the Branching Dual’, to appear in INFORMS Journal on Computing.

### File 1: random\_turner.py

This python script was developed using python 2.7 and generates undirected random graphs according to the Turner model, where the adjacency matrix of the graph can only contain non-zero entries at distance no more than  $k$  from the diagonal, and each of the entries within this distance is non-zero with some probability  $p$ . To use, execute ‘*python random\_turner.py n k p*’ from a command line where

1.  $n$  is the number of vertices in the graph you are generating;
2.  $k$  is the maximum allowable distance a non-zero entry may be from the diagonal of the adjacency matrix; and
3.  $p$  is the probability of an allowable edge (independently) existing.

After execution, ten connected graphs will be stored in the current working directory.

### File 2: randomgraph\_S.nb

This is a Wolfram Mathematica notebook (developed using version 11.0) that generates random graphs using Mathematica’s built-in RandomGraph function, where every edge in the graph independently has some probability  $p$  of existing. To use, open the notebook in Mathematica, and execute the block of code (often with Shift+Enter). A number of random graph files will be generated as a result of the execution. The following variables may be modified according to your needs:

1.  $v$  – the number of vertices in the graph;
2. numgraphs – The number of graphs of every density to generate
3. density – The starting value of the probability  $p$ ;
4. densityIncrement – How much the density is increased before a new set of graphs will be generated.

Output files are stored in the same folder as the notebook.

### Output file format

The graphs are output in the DIMACS format (see, for example, [http://lcs.ios.ac.cn/~caisw/Resource/about DIMACS graph format.txt](http://lcs.ios.ac.cn/~caisw/Resource/about_DIMACS_graph_format.txt) for more information).