Minimum Vertex Cover

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13.11.2015
MinVertexCover-0.01

Abstract

This is a C++ implementation of the approximated solution to minimum vertex cover problem utilizing the list heuristic with static ordering based on vertex covering number (node degree). This solution has been proven to have $O(\frac{\sqrt{\Delta}}{2} + \frac{3}{2})$ approximation ratio for a decreasing node degree [1].

Contents

1 Installation

The simplest way to compile this program is to:

1. Unpack the MinVertexCover package (`minvertexcover-XXX.tar.gz`):

   ```
   tar -xvzf minvertexcover-XXX.tar.gz
   ```

2. Change the current directory to `minvertexcover-XXX`:

   ```
   cd minvertexcover-XXX/
   ```

3. Configure the program for your system (–bindir is optional):

   ```
   ./configure --bindir=/absolute/directory/path/minvertexcover-xxx/bin
   ```

4. Compile the program:

   ```
   make
   ```

5. Install the program:

   ```
   make install
   ```

Your binaries should be located in your local bin directory if `--bindir` option has been set. Otherwise installation needs to be carried out with root privileges in order to be installed into `/usr/local/bin` directory.

2 Input files

MinVexCov application takes a simple two column (tab separated) file, containing vertices with their relations defined as pairs: first column contains successor (child) vertexes and the second column their predecessors (parents). An example of the input file can be found in `./minvertexcover-xxx/demo` directory and should look like this:

`Graph`:

```
2	1
4	1
a	1
t	1
t	a
2	a
8	2
5	1
67	2
6	3
23	b
b	2
34	b
21	b
14	4
15	6
68	3
3	2
11	67
17	67
```

3 Program options

I order to see program options type:

```
./bin/MinVexCov -h
```

Expected output:

```
Usage: ./program [options]



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                            by Robert Bakaric

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LICENSE:
   The program is distributed under the GNU General Public License.
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   software. If not, see http://www.gnu.org/licenses/
----------------------------------------------------------------------
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Options:
  -h [ --help ]            produce help message
  -v [ --version ]         print version information
  -i [ --input-file ] arg  input file
  -o [ --output-file ] arg output file
```

4 Example

4.1 MinVexCov.cpp

A minimal example demonstrating the usage of MinVexCov demo program:

```
./bin/VexCov -i ./demo/Graph

Minimum Vertex Cover has: 8 (8/OPT <= 2) vertices

Vertices covering the graph:
67
b
1
2
a
6
4
3
```

4.2 MinVertexCover.hpp

A minimal example demonstrating the usage of functions in VexCov class (*MinVertexCover.hpp header file*):

```
    #include<vector>
    #include<string>
    #include<MinVertexCover.hpp>

    using namespace vex;

    vector<string> parent {1,1,1,1,a,a,2,1,2,3,b,2,b,b,4,6,3,2,67,67};
    //  any type/object is accepted (int, long, char,string...)
    vector<string> child  {2,4,a,t,t,2,8,5,67,6,23,b,34,21,14,15,68,3,11,17};
    //  any type/object is accepted (int, long, char,string...)

/* Constructor */
    VexCov<string,int> Vex(parent,child);
    /*OR*/
    VexCov<string,int> Vex;
    VexCov<string,int> Vex.Make(parent,child);

    vector<string> results = Vex.GetMinVexCov();    //  prints: 67,b,1,2,a,6,4,3,
    Vex.GetError();                                 //  prints approximation ratio: 2

/* Explicit destructor */

   Vex.Purge();
```

5 Acknowledgement

1. David Avis and Tomokazu Imamura, 2007., A list heuristic for vertex cover,Operations Research Letters 35(2):201-204.

6 Future work

Upon request.