

Project title

Demonstration tool for teaching and learning of a graph generation procedure from set equations by using PSTricks

Supervisor

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Brief description

The goal of this Project is to implement a demonstrating tool for graph generation from arbitrary given system of set equations like this one

$$u = \{m : u, l : v\}$$

$$v = \{\}$$

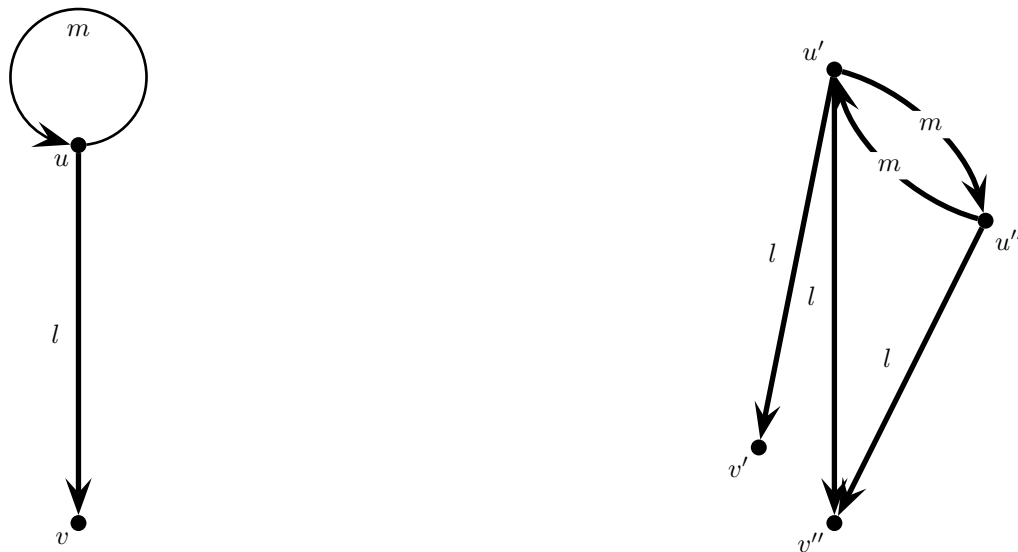
$$u' = \{m : u'', l : v', l : v''\}$$

$$u'' = \{m : u', l : v''\}$$

$$v' = \{\}$$

$$v'' = \{\}$$

For this concrete system of set equations the generated graph consists of two parts:



The generation process should proceed automatically or semi-automatically, step-by-step to serve as explanatory tool demonstrating this process. See also the general description of this procedure and examples in the slides to the module COMP311 “Semistructured and web-like Databases”.

The input for this program should be a text file with arbitrary system of set equations like above. At the start, the program should check syntactical correctness of the system of set equations and to show to the user where is the syntax error, if any. In the case of nested bracket expressions the program should unnest them. Then it should generate the output as a postscript file (viewed by GSview). The intermediate output is \LaTeX file containing commands of the known package PSTricks for describing graphics in \LaTeX . See Appendix below for the example of \LaTeX file containing pstricks commands for drawing the above graph.

Note that drawing such a graph requires some coordinates to assign to the nodes of the graph. They could be generated randomly. But then the resulting graph might look messy. So, the user should additionally be given a natural and user friendly “tuning” tool (actually the most creative part of the project) allowing to change smoothly these coordinates (in the \LaTeX file) to amend the shape of the graph as desired and without enforcing the user to edit manually the \LaTeX file. For example, instead of manual changing coordinates of the graph nodes we could drag-and-drop them by using the mouse with coordinates changing automatically. A simpler way could be an option given for each node (node name) to change its coordinates e.g. by using the mouse wheel. The simplest but least convenient way would be just opening the latex file with PSTRICS fragment and changing the coordinates manually. Even in this case all essential components of the file should be already created automatically and only coordinates should be amended manually. Thus, it still makes a sense, although less convenient. (In this case it hardly can be used for learning and teaching, only for generating graphs. For learning and teaching, the Latex file with PSTRICS fragment should be completely hidden from the user as irrelevant to the process of teaching and learning.)

For a student working on this project this would be a good and challenging opportunity to apply his/her programming skills and to learn some (actually very small) fragments of \LaTeX and PSTRICS.

Background requirements

Familiarity with all \LaTeX and PSTRICS features, however desirable, is formally unnecessary before starting this project. Only the simplest fragments of them will be used and could be studied in the first stage of working on the Project. However, appropriate programming skills are necessary.

Appendix (example)

Example of a \LaTeX file describing some picture by using the commands of PSTricks:

```
\documentclass[a4paper]{article}
\usepackage{latexsym}
\usepackage{amssymb} % whatever you need, e.g. amsmath, latexsym, etc.
\usepackage{pst-node} %pstricks package
\usepackage{pst-text} %pstricks package
\usepackage{pst-poly} %pstricks package
\usepackage{pstricks} %pstricks package

\begin{document}
\section*{Example of a graph}
\begin{center}
\psset{unit=1.0 cm}
\begin{pspicture}(-7.0,0.0)(8.0,8.0)
%\psgrid[gridwidth=0.01,subgriddiv=10]
\cnode*(-5.0,6.0){3.0pt}{u}
\uput[dl](-5.0,6.0){$u$}

\cnode*(-5.0,1.0){3.0pt}{v}
\uput[dl](-5.0,1.0){$v$}

\cnode*(5.0,7.0){3.0pt}{u'}
\uput[ul](5.0,7.0){$u'$}

\cnode*(7.0,5.0){3.0pt}{u''}
\uput[dr](7.0,5.0){$u''$}

\cnode*(5.0,1.0){3.0pt}{v''}
\uput[dl](5.0,1.0){$v''$}

\cnode*(4.0,2.0){3.0pt}{v'}
\uput[dl](4.0,2.0){$v'$}

\ncarc[arcangle=0,linewidth=2pt,arrowsize=10pt]{->}{u}{v}
\Bput{$l$}
\ncarc[arcangle=0,linewidth=2pt,arrowsize=10pt]{->}{u'}{v'}
\Bput{$l$}
\ncarc[arcangle=0,linewidth=2pt,arrowsize=10pt]{->}{u'}{v''}
\Bput{$l$}
\ncarc[arcangle=0,linewidth=2pt,arrowsize=10pt]{->}{u''}{v''}
\Bput{$l$}
\ncarc[arcangle=30,linewidth=2pt,arrowsize=10pt]{->}{u'}{u''}
\mput*{$m$}
\ncarc[arcangle=-30,linewidth=2pt,arrowsize=10pt]{<-}{u'}{u''}
\mput*{$m$}

\ncircle[angleB=180,nodesepA=0.0,linewidth=1pt,arrowsize=10pt]{->}{u}{0.9}
\Aput{$m$}

\end{pspicture}
\end{center}
\end{document}
```

And the same with

```
\psgrid[gridwidth=0.01,subgriddiv=10]
```

uncommented (i.e., with % before this line omitted):

Example of a graph

