2

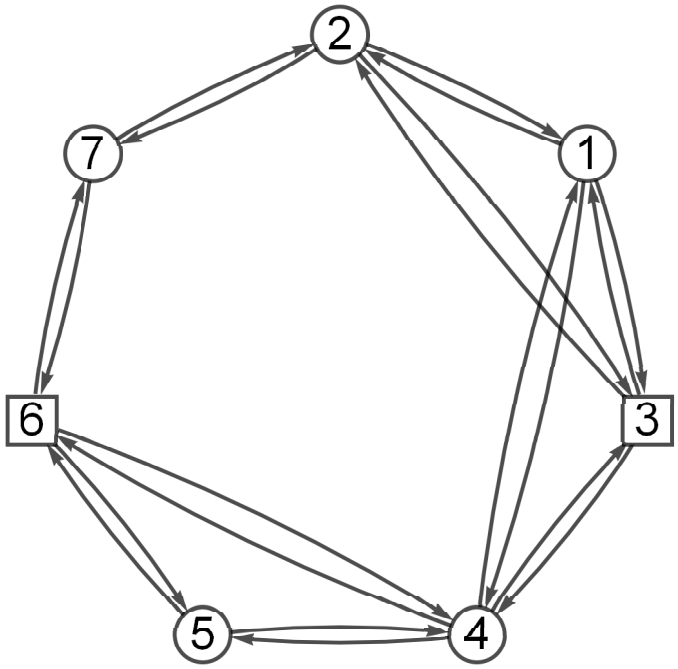
```
ClearAll["Global*"]
SetDirectory[NotebookDirectory[]];
Needs["FlowSolver"]

readGraph2[file_, dir_]:=Module[{
  fn = FileNameJoin[{dir, file}],
  stream, imod, umod, u, b
  },
  stream = OpenRead[fn];
  imod = Read[stream, {Word, Number}][[2]];
  umod = Read[stream, {Word, Number}][[2]];
  u = ({#[[1]]#[[2]], #[[2]]#[[1]]} &/@ReadList[stream, Expression, umod]) //Flatten;
b = ConstantArray[0, imod];
  (b[[Read[StringToStream[StringTake[#1, {5, -3}]], Number]]] = #2)&@@@ReadList[stream, {Word, Expressi
{Graph[u, VertexSize->Medium, VertexLabels → Placed["Name", Center], VertexStyle → Directive[White],
VertexShapeFunction → {xx_ :→ If[SameQ[b[[xx]], x], "Square", "Circle"]}, VertexLabelStyle->Directive[Black,
b}]

forma[ff_]:= ((ff/. {ξ_u_v_ → ξu,v}) //TableForm)


{g, b} = readGraph2["gr.txt", NotebookDirectory[]];
GraphPlot[g, EdgeStyle → Directive[Black, Thick], VertexStyle → Directive[EdgeForm[Thick], White], Multiedg
```

Out[ ]=




```
balanceEqs = ((Total [x_#&/@EdgeList[g, _#]] - Total [x_#&/@EdgeList[g, #_]])) == MapIndexed [#1/.x → x_
balanceEqs//forma
```

$$x_{2,7} + x_{6,7} - x_{7,2} - x_{7,6} == 0$$

$$x_{1,2} - x_{2,1} - x_{2,3} - x_{2,7} + x_{3,2} + x_{7,2} == 0$$

$$x_{4,6} + x_{5,6} - x_{6,4} - x_{6,5} - x_{6,7} + x_{7,6} == x_6$$

$$-x_{1,2} - x_{1,3} - x_{1,4} + x_{2,1} + x_{3,1} + x_{4,1} == 0$$

$$x_{1,3} + x_{2,3} - x_{3,1} - x_{3,2} - x_{3,4} + x_{4,3} == x_3$$

$$x_{1,4} + x_{3,4} - x_{4,1} - x_{4,3} - x_{4,5} - x_{4,6} + x_{5,4} + x_{6,4} == 0$$

$$x_{4,5} - x_{5,4} - x_{5,6} + x_{6,5} == 0$$

```
M = {7};
Print["M = ", M];
```

M = {7}

```
(*incL = DeleteCases[DeleteDuplicates[Cases[IncidenceList[g, #], i_j_ :→ {i, j}]//Flatten], v_/;v == #]&/@M*
incL = (IncidenceList[g, #]&/@M)//Flatten
```

$\{72, 27, 76, 67\}$

(*Do [If [MemberQ [$M, j_{[[1]]}$] , $b_{[[j[[2]]]]}$+=f_j, $b_{[[j[[1]]]]}$-=f_j] , {j, incL}] *)

$\bar{b}$ = Fold [If [MemberQ [M, #2$_{[[1]]}$] , ReplacePart [#, #2$_{[[2]]}$ → #$_{[[\#2[[2]]]]}$ + $f_{\#2}$] , ReplacePart [#, #2$_{[[1]]}$ → #[

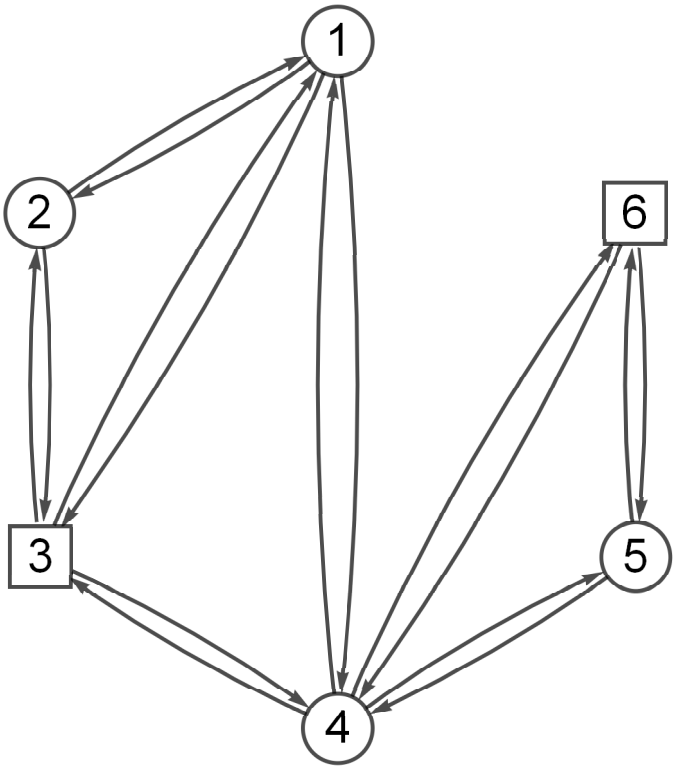
$\bar{b}$ = Delete [$\bar{b}$, #] &@@M;

$\overline{ng}$ = VertexDelete[g, M];

GraphPlot [$\overline{ng}$, EdgeStyle → Directive[Black, Thick], VertexStyle → Directive[EdgeForm[Thick], White], Multiec

$\bar{b}$

Out[ ]=



$\{0, -f_{27} + f_{72}, x, 0, 0, x - f_{67} + f_{76}\}$

CC[g_, M_]:=(DeleteDuplicates[Cases[IncidenceList[g, #], i_j_/;j == #]]&/@M)//Flatten

ii$_{i_}^{+}$[g_]:=Cases[IncidenceList[g, i], u_v_/;u == i :→ v]

$M^+ = \text{CC}[g, M]$

$\{27, 67\}$

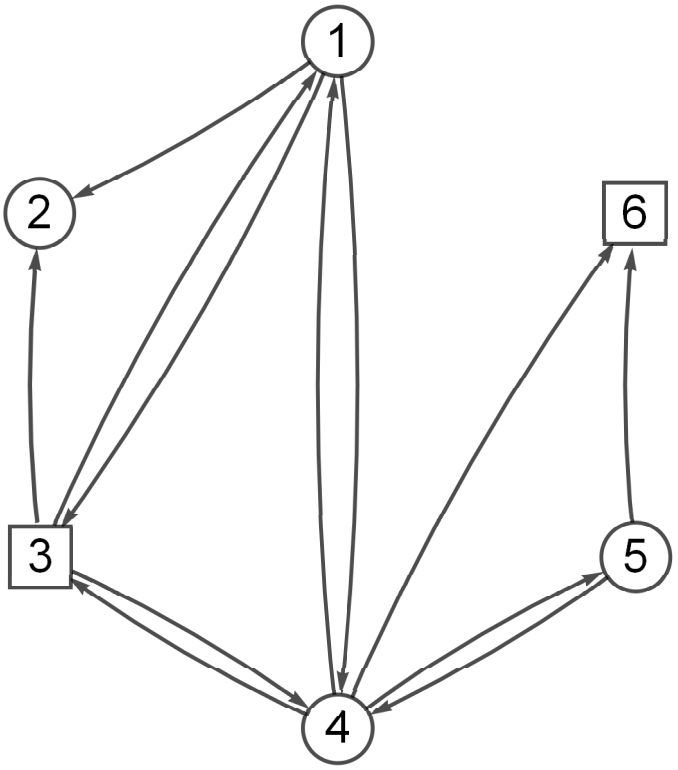
$\overline{\text{b1}} = \text{Fold}\left[\text{Module}\left[\left\{\text{bb} = \#1, i = \#2_{[[1]]}, k = \#2_{[[2]]}\right\}, \left(\text{ReplacePart}\left[\text{bb}, \left(\left(\left(\left\{\# \to \text{bb}_{[[\#]]} + \frac{p_{i\#}}{p_{ik}} f_{ik}, i \to \text{bb}_{[[}\right.\right.\right.\right.\right.\right.$

$\left\{\frac{f_{27} p_{21}}{p_{27}}, -f_{27} + f_{72} - \frac{f_{27} p_{21}}{p_{27}}, x + \frac{f_{27} p_{23}}{p_{27}}, \frac{f_{67} p_{64}}{p_{67}}, \frac{f_{67} p_{65}}{p_{67}}, x - f_{67} + f_{76} - \frac{f_{67} p_{65}}{p_{67}}\right\}$

$\text{GraphPlot}\left[\text{Fold}\left[\text{HighlightGraph}[\#1, \text{u\_v\_}/; u == \#2, \text{GraphHighlightStyle} \to \text{“White”}]\&, \overline{\text{ng}}, \#_{[[1]]}\&/@M^+\right],\right.$

$\text{VertexStyle} \to \text{Directive}[\text{EdgeForm}[\text{Thick}], \text{White}], \text{MultiedgeStyle} \to .05]$

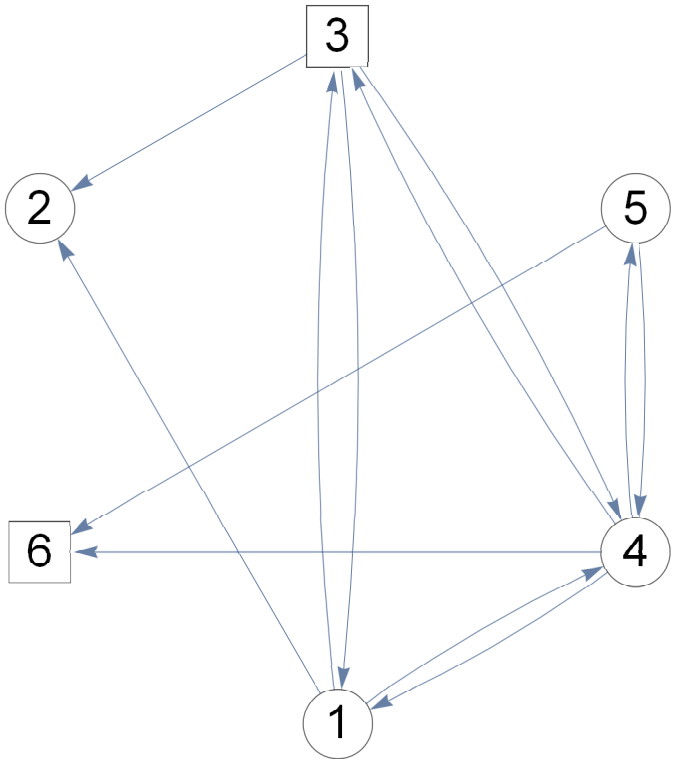
Out[ ]=



$\overline{\text{g1}} = \text{Fold}\left[\text{EdgeDelete}[\#1, \text{u\_v\_}/; u == \#2]\&, \overline{\text{ng}}, \#_{[[1]]}\&/@M^+\right];$

$\text{GraphPlot}\left[\overline{\text{g1}}, \text{MultiedgeStyle} \to .05\right]$

Out[ ]=



$\mathbf{II_{rem}} = \mathbf{VertexList}\left[\overline{\mathbf{g1}}\right] \sim \mathbf{Complement} \sim (M^{+}[[\mathbf{All}, 1]])$

$\{1, 3, 4, 5\}$

$\boldsymbol{\lambda} = \mathbf{SparseArray}\left[\mathbf{Replace}\left[\left(\mathbf{EdgeList}\left[\overline{\mathbf{g1}}\right] /.\#\&/@\mathbf{Flatten}\left[\mathbf{Module}\left[\{i = \#, \mathbf{jf}, \mathbf{Icur}\}, \left(\mathbf{Icur} = \mathbf{ii}_{i}^{+}\left[\overline{\mathbf{g1}}\right]\right.\right.\right.\right.\right.$

$\left.\left.\left.\mathbf{jf} = \mathbf{First}[\mathbf{Icur}];\right.\right.\right.$

$\left.\left.\left.\left(\left\{(ijf) \to 1, (i\#) \to -\frac{p_{i\#}}{p_{ijf}}\right\}\right) \&/@\mathbf{Icur}[[2;;]]\right)\right] \&/@\mathbf{II_{rem}}, 1\right]\right), \_\_ \to 0, 2\right]\right]$

SparseArray $\left[\square\right]$

$\mathbf{Grid}[\boldsymbol{\lambda}]$

$$\begin{array}{cccccccccccc}
1 & 0 & -\frac{p_{13}}{p_{12}} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
1 & 0 & 0 & 0 & -\frac{p_{14}}{p_{12}} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & -\frac{p_{31}}{p_{32}} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & -\frac{p_{34}}{p_{32}} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & -\frac{p_{43}}{p_{41}} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & -\frac{p_{45}}{p_{41}} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & -\frac{p_{46}}{p_{41}} \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & -\frac{p_{56}}{p_{54}} & 0
\end{array}$$

$g = \overline{\text{g1}};$

$b = \overline{\text{b1}};$

$\text{II}^* = \text{Cases}[\text{MapIndexed}[\{\#1, \#2\}\&, b], \{\text{el\_}, \text{i\_}\}/;\text{MemberQ}[\text{el}, x] :\to i]//\text{Flatten}$

$\{3, 6\}$

$\text{buildt} = \text{Timing}\left[\{t, g\} = \text{buildTree}\left[g, \text{II}^*\right];\right][[1]]$

$\text{TableForm}[t[[1;;4]], \text{TableHeadings} \to \{\{\text{“pred”}, \text{“dir”}, \text{“depth”}, \text{d}\}, t//\text{pred}//\text{Length}//\text{Range}\}]$

0.015625

	1	2	3	4	5	6	7
pred	3	3	7	6	6	7	0
dir	1	1	1	−1	−1	1	0
depth	2	2	1	2	2	1	0
d	2	7	1	5	3	4	6

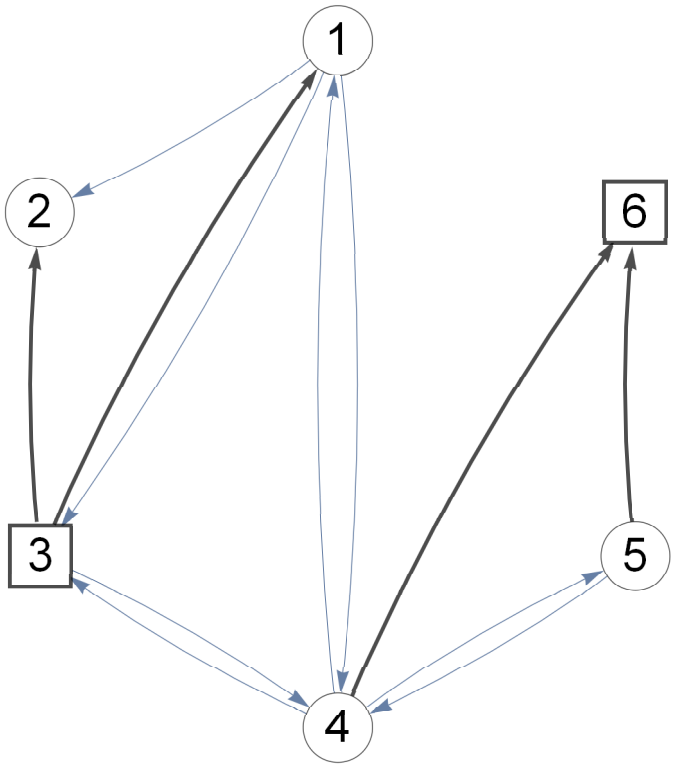
$\text{GraphPlot}\left[\text{HighlightGraph}\left[\text{Fold}\left[\text{HighlightGraph}[\#1, \text{Style}[\text{u\_v\_}/;u == \#2, \text{White}]]\&, \overline{\text{ng}}, \#_{[[1]]}\&/@M^+\right],\right.\right.$

$\{\text{Style}[\text{u\_}/;\text{VertexQ}[g, u]\&\&\text{pred}[t][[u]] == 7, \text{EdgeForm}[\text{Thick}]],$

$\text{Style}[\text{u\_v\_}/;(\text{pred}[t][[u]] == v\&\&\text{dir}[t][[u]] == -1)\|(\text{pred}[t][[v]] == u\&\&\text{dir}[t][[v]] == 1), \text{Directive}[\text{Black}, \text{Thick}$

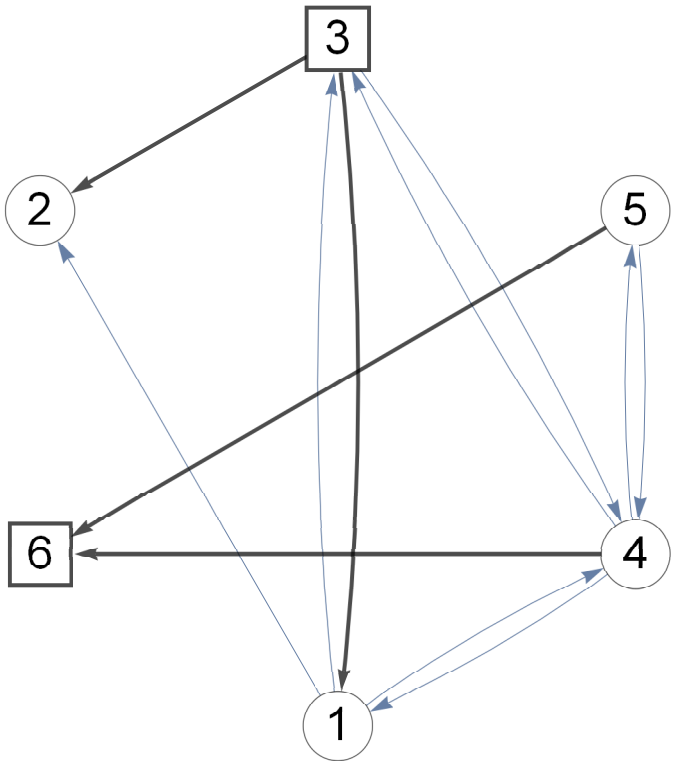
$\text{MultiedgeStyle} \to .05]$

Out[ ]=

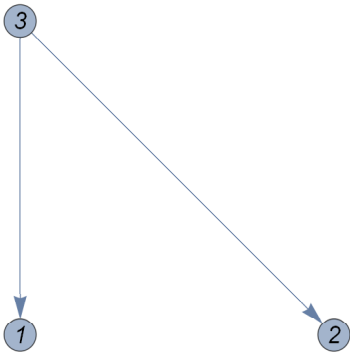



```
GraphPlot[
HighlightGraph [g1, {Style[u_/;VertexQ[g, u]&&pred[t][[u]] == 7, EdgeForm[Thick]],
Style[u_v_/;(pred[t][[u]] == v&&dir[t][[u]] == -1)||(pred[t][[v]] == u&&dir[t][[v]] == 1), Directive[Black, Thick
MultiedgeStyle → .05]
```

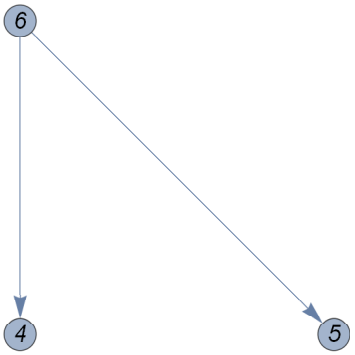
Out[ ]=



VertexDelete[*t*[[7]], 7](* *)

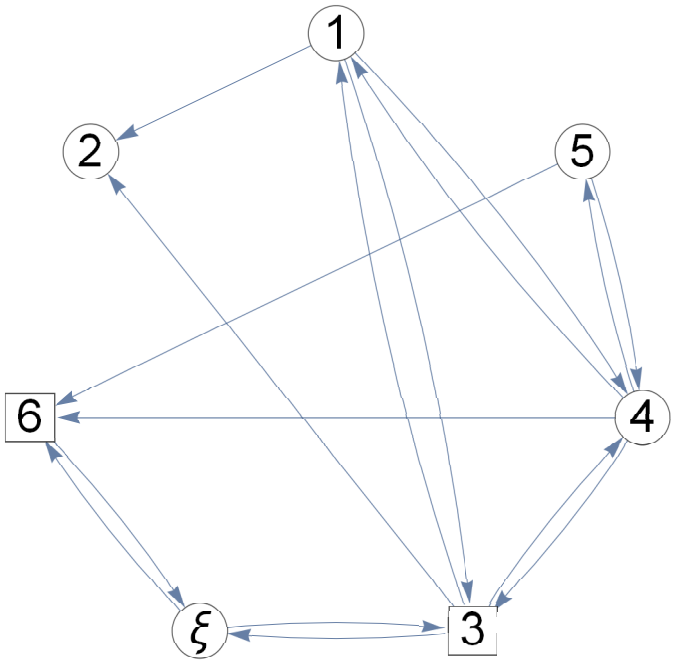


Out[ ]=



GraphPlot[*g*, MultiedgeStyle → .05]

Out[ ]=



AppendTo[*b*, −Total[*b*]];

b = Simplify[b/.x → 0]

$$\left\{\frac{f_{27}p_{21}}{p_{27}}, f_{72}+f_{27}\left(-1-\frac{p_{21}}{p_{27}}\right), \frac{f_{27}p_{23}}{p_{27}}, \frac{f_{67}p_{64}}{p_{67}}, \frac{f_{67}p_{65}}{p_{67}}, f_{76}+f_{67}\left(-1-\frac{p_{65}}{p_{67}}\right), -f_{72}-f_{76}+f_{27}\left(1-\frac{p_{23}}{p_{27}}\right)+f_{67}\left(1-\right.\right.$$

balanceEqs = ((Total [$x_{\#}$&/@EdgeList[g, _#]] − Total [$x_{\#}$&/@EdgeList[g, #_]]) /.7 → ξ) == b[[#]]&/@VertexI

balanceEqs//forma

$$x_{1,2}+x_{3,2} == f_{7,2}+f_{2,7}\left(-1-\frac{p_{2,1}}{p_{2,7}}\right)$$

$$x_{4,6}+x_{5,6}-x_{6,\xi}+x_{\xi,6} == f_{7,6}+f_{6,7}\left(-1-\frac{p_{6,5}}{p_{6,7}}\right)$$

$$-x_{1,2}-x_{1,3}-x_{1,4}+x_{3,1}+x_{4,1} == \frac{f_{2,7}p_{2,1}}{p_{2,7}}$$

$$x_{1,3}-x_{3,1}-x_{3,2}-x_{3,4}-x_{3,\xi}+x_{4,3}+x_{\xi,3} == \frac{f_{2,7}p_{2,3}}{p_{2,7}}$$

$$x_{1,4}+x_{3,4}-x_{4,1}-x_{4,3}-x_{4,5}-x_{4,6}+x_{5,4} == \frac{f_{6,7}p_{6,4}}{p_{6,7}}$$

$$x_{4,5}-x_{5,4}-x_{5,6} == \frac{f_{6,7}p_{6,5}}{p_{6,7}}$$

$$x_{3,\xi}+x_{6,\xi}-x_{\xi,3}-x_{\xi,6} == -f_{7,2}-f_{7,6}+f_{2,7}\left(1-\frac{p_{2,3}}{p_{2,7}}\right)+f_{6,7}\left(1-\frac{p_{6,4}}{p_{6,7}}\right)$$

ps = partSolve [g, −b, t, $\tilde{x}$] ;

ps//forma

7

$\tilde{x}_{1,2} \to 0$

$\tilde{x}_{1,3} \to 0$

$\tilde{x}_{1,4} \to 0$

$\tilde{x}_{3,1} \to \frac{f_{2,7} p_{2,1}}{p_{2,7}}$

$\tilde{x}_{3,2} \to f_{7,2} + f_{2,7} \left(-1 - \frac{p_{2,1}}{p_{2,7}}\right)$

$\tilde{x}_{3,4} \to 0$

$\tilde{x}_{3,7} \to 0$

$\tilde{x}_{4,1} \to 0$

$\tilde{x}_{4,3} \to 0$

$\tilde{x}_{4,5} \to 0$

$\tilde{x}_{4,6} \to -\frac{f_{6,7} p_{6,4}}{p_{6,7}}$

$\tilde{x}_{5,4} \to 0$

$\tilde{x}_{5,6} \to -\frac{f_{6,7} p_{6,5}}{p_{6,7}}$

$\tilde{x}_{6,7} \to 0$

$\tilde{x}_{7,3} \to f_{7,2} + f_{2,7} \left(-1 - \frac{p_{2,1}}{p_{2,7}}\right) + \frac{f_{2,7} p_{2,1}}{p_{2,7}} + \frac{f_{2,7} p_{2,3}}{p_{2,7}}$

$\tilde{x}_{7,6} \to f_{7,6} + f_{6,7} \left(-1 - \frac{p_{6,5}}{p_{6,7}}\right) + \frac{f_{6,7} p_{6,4}}{p_{6,7}} + \frac{f_{6,7} p_{6,5}}{p_{6,7}}$

Simplify [(balanceEqs/. {$x \to \tilde{x}, \xi \to 7$}) /.ps]

{True, True, True, True, True, True, True}

matrt = Timing[δMatr = δ1[g, t]];

rootT = VertexCount[g];

$$\texttt{TableForm}\left[\delta\texttt{Matr}, \texttt{TableHeadings} \to \left\{\texttt{uNb}[g,t], \delta\begin{cases} \#_{[[2]]} & \#_{[[1]]} == \texttt{rootl} \\ \#_{[[1]]} & \#[[2]] == \texttt{rootl} \\ \# & \texttt{True} \end{cases}\&/@\texttt{EdgeList}[g]\right\}\right]\texttt{//forma}$$

	$\delta_{1,2}$	$\delta_{3,2}$	$\delta_{1,3}$	$\delta_{3,1}$	$\delta_{1,4}$	$\delta_{4,1}$	$\delta_{3,4}$	$\delta_{4,3}$	$\delta_{4,5}$	$\delta_{5,4}$	$\delta_{5,6}$	$\delta_{4,6}$	δ_{3}	δ_{6}	δ_{3}	δ_{6}
12	1	-1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	1	1	0	0	0	0	0	0	1	1	-1	0	0
41	0	0	0	-1	0	1	0	0	0	0	0	-1	-1	1	0	0
34	0	0	0	0	0	0	1	0	0	0	0	1	1	-1	0	0
43	0	0	0	0	0	0	0	1	0	0	0	-1	-1	1	0	0
45	0	0	0	0	0	0	0	0	1	0	1	-1	0	0	0	0
54	0	0	0	0	0	0	0	0	0	1	-1	1	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
67	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1

$$\lambda = \texttt{SparseArray}[\lambda, \{\texttt{Length}[\lambda], \texttt{Length}[\lambda[[1]]] + 4\}];$$

$$(*\lambda = \lambda[[;; -2]]*)$$

$$\texttt{dopEq} = \# == 0\&/@\texttt{Flatten}\left[\lambda.\left\{x_{\#}\&/@\texttt{EdgeList}[g]\right\}^{\mathsf{T}}\right];$$

$$\texttt{dopEq//forma}$$

$$x_{1,2} - \frac{p_{1,3}x_{1,3}}{p_{1,2}} == 0$$

$$x_{1,2} - \frac{p_{1,4}x_{1,4}}{p_{1,2}} == 0$$

$$-\frac{p_{3,1}x_{3,1}}{p_{3,2}} + x_{3,2} == 0$$

$$x_{3,2} - \frac{p_{3,4}x_{3,4}}{p_{3,2}} == 0$$

$$x_{4,1} - \frac{p_{4,3}x_{4,3}}{p_{4,1}} == 0$$

$$x_{4,1} - \frac{p_{4,5}x_{4,5}}{p_{4,1}} == 0$$

$$x_{4,1} - \frac{p_{4,6}x_{4,6}}{p_{4,1}} == 0$$

$$x_{5,4} - \frac{p_{5,6}x_{5,6}}{p_{5,4}} == 0$$

$\Lambda = \lambda.(\delta\text{Matr})^{\intercal}$;

“cicle det’s:”

Λ//forma

cicle det’s:

$$\begin{array}{cccccccccc}
1 & -\frac{p_{13}}{p_{12}} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
1 & 0 & -\frac{p_{14}}{p_{12}} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-1 - \frac{p_{31}}{p_{32}} & -\frac{p_{31}}{p_{32}} & -\frac{p_{31}}{p_{32}} & \frac{p_{31}}{p_{32}} & 0 & 0 & 0 & 0 & 0 & 0 \\
-1 & 0 & 0 & 0 & -\frac{p_{34}}{p_{32}} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & -\frac{p_{43}}{p_{41}} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & -\frac{p_{45}}{p_{41}} & 0 & 0 & 0 \\
0 & 0 & -\frac{p_{46}}{p_{41}} & 1 + \frac{p_{46}}{p_{41}} & -\frac{p_{46}}{p_{41}} & \frac{p_{46}}{p_{41}} & \frac{p_{46}}{p_{41}} & -\frac{p_{46}}{p_{41}} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{p_{56}}{p_{54}} & 1 + \frac{p_{56}}{p_{54}} & 0 & 0
\end{array}$$

"U_c="

U_c = Range[8]

"U_{nc}="

$U_{\text{nc}} = \{9, 10\}$

$U_c =$

$\{1, 2, 3, 4, 5, 6, 7, 8\}$

$U_{\text{nc}} =$

$\{9, 10\}$

Λc = Λ [[All, U_c]] ;

Λnc = Λ [[All, U_{nc}]] ;

"Λ_c="

Λc//MatrixForm

$\Lambda_c =$

$$\begin{pmatrix} 1 & -\frac{p_{13}}{p_{12}} & 0 & 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & -\frac{p_{14}}{p_{12}} & 0 & 0 & 0 & 0 & 0 \\ -1-\frac{p_{31}}{p_{32}} & -\frac{p_{31}}{p_{32}} & -\frac{p_{31}}{p_{32}} & \frac{p_{31}}{p_{32}} & 0 & 0 & 0 & 0 \\ -1 & 0 & 0 & 0 & -\frac{p_{34}}{p_{32}} & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & -\frac{p_{43}}{p_{41}} & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & -\frac{p_{45}}{p_{41}} & 0 \\ 0 & 0 & -\frac{p_{46}}{p_{41}} & 1+\frac{p_{46}}{p_{41}} & -\frac{p_{46}}{p_{41}} & \frac{p_{46}}{p_{41}} & \frac{p_{46}}{p_{41}} & -\frac{p_{46}}{p_{41}} \\ 0 & 0 & 0 & 0 & 0 & 0 & -\frac{p_{56}}{p_{54}} & 1+\frac{p_{56}}{p_{54}} \end{pmatrix}$$

"det(Λ_c)="

Simplify[det = Det[Λc]]//forma

$\det(\Lambda_c)=$

$$-\frac{1}{p_{1,2}^2 p_{3,2}^2 p_{4,1}^3 p_{5,4}} \left(p_{1,2}p_{3,1}p_{3,4}\left(p_{1,3}p_{4,1}\left(p_{4,5}p_{4,6}\left(p_{5,4}+p_{5,6}\right)+p_{4,3}\left(p_{4,6}p_{5,4}+p_{4,5}\left(p_{5,4}+p_{5,6}\right)\right)\right)+p_{1,4}\left(p_{4,3}p_{4,5}p_{4,6}\right.\right.\right.$$

"U_T="

utind = Cases[t[[6]], $\xi\_/;\xi \neq 0$];

U_T = EdgeList[g][[utind]]

$U_T =$

$\{31, 32, 73, 46, 56, 76\}$

"$U_{\mathbf{Nb}}$="

$U_{\mathbf{Nb}} = \mathbf{uNb}[g, t]$

$U_{\mathrm{Nb}} =$

$\{12, 13, 14, 41, 34, 43, 45, 54, 37, 67\}$

$A = -\lambda.\,\{\tilde{x}_{\#}\&/@\mathbf{EdgeList}[g]\}^{\mathsf{T}}/.\mathbf{ps};$

"A="

A//MatrixForm

A=

$$\begin{pmatrix} 0 \\ 0 \\ -f_{72} - f_{27}\left(-1 - \frac{p_{21}}{p_{27}}\right) + \frac{f_{27} p_{21} p_{31}}{p_{27} p_{32}} \\ -f_{72} - f_{27}\left(-1 - \frac{p_{21}}{p_{27}}\right) \\ 0 \\ 0 \\ -\frac{f_{67} p_{46} p_{64}}{p_{41} p_{67}} \\ -\frac{f_{67} p_{56} p_{65}}{p_{54} p_{67}} \end{pmatrix}$$

$\beta = A - \Lambda\mathbf{nc}.\,\{x_{\#}\&/@U_{\mathbf{Nb}}\,[[U_{\mathbf{nc}}]]\}^{\mathsf{T}};$

"β="

β//forma

$\beta =$

0

0

$-f_{7,2} - f_{2,7}\left(-1 - \frac{p_{2,1}}{p_{2,7}}\right) + \frac{f_{2,7}p_{2,1}p_{3,1}}{p_{2,7}p_{3,2}}$

$-f_{7,2} - f_{2,7}\left(-1 - \frac{p_{2,1}}{p_{2,7}}\right)$

0

0

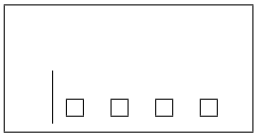
$_\frac{f_{6,7}p_{4,6}p_{6,4}}{p_{4,1}p_{6,7}}$

$_\frac{f_{6,7}p_{5,6}p_{6,5}}{p_{5,4}p_{6,7}}$

" $\Lambda_c x_c = \beta$:"

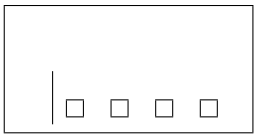
xc = LinearSolve[Λc, β]

$\Lambda_c x_c = \beta$:



xcp = MapThread [$x_{\#1} \to$ #2&, {U_{Nb} [[U_c]] , Flatten[xc]}] ;

xcp//TableForm



***s* = solveAll[*g*, *t*];**

***s*//TableForm**

$x_{32} \to f_{72} + f_{27}\left(-1 - \frac{p_{21}}{p_{27}}\right) - x_{12}$

$x_{31} \to \frac{f_{27}p_{21}}{p_{27}} + x_{12} + x_{13} + x_{14} - x_{41}$

$x_{56} \to -\frac{f_{67}p_{65}}{p_{67}} + x_{45} - x_{54}$

$x_{46} \to -\frac{f_{67}p_{64}}{p_{67}} + x_{14} + x_{34} - x_{41} - x_{43} - x_{45} + x_{54}$

$x_{73} \to f_{72} + f_{27}\left(-1 - \frac{p_{21}}{p_{27}}\right) + \frac{f_{27}p_{21}}{p_{27}} + \frac{f_{27}p_{23}}{p_{27}} + x_{14} + x_{34} + x_{37} - x_{41} - x_{43}$

$x_{76} \to f_{76} + f_{67}\left(-1 - \frac{p_{65}}{p_{67}}\right) + \frac{f_{67}p_{64}}{p_{67}} + \frac{f_{67}p_{65}}{p_{67}} - x_{14} - x_{34} + x_{41} + x_{43} + x_{67}$

“ :”

xsol = (*s* ∼ Join ∼ xcp);

xsol/. {ξ_u_v_ → ξ*u*,*v*} //Simplify//TableForm

:

$$x_{3,2} \to f_{7,2} + f_{2,7}\left(-1 - \frac{p_{2,1}}{p_{2,7}}\right) - x_{1,2}$$

$$x_{3,1} \to \frac{f_{2,7}p_{2,1}}{p_{2,7}} + x_{1,2} + x_{1,3} + x_{1,4} - x_{4,1}$$

$$x_{5,6} \to -\frac{f_{6,7}p_{6,5}}{p_{6,7}} + x_{4,5} - x_{5,4}$$

$$x_{4,6} \to -\frac{f_{6,7}p_{6,4}}{p_{6,7}} + x_{1,4} + x_{3,4} - x_{4,1} - x_{4,3} - x_{4,5} + x_{5,4}$$

$$x_{7,3} \to f_{7,2} + f_{2,7}\left(-1 + \frac{p_{2,3}}{p_{2,7}}\right) + x_{1,4} + x_{3,4} + x_{3,7} - x_{4,1} - x_{4,3}$$

$$x_{7,6} \to f_{7,6} + f_{6,7}\left(-1 + \frac{p_{6,4}}{p_{6,7}}\right) - x_{1,4} - x_{3,4} + x_{4,1} + x_{4,3} + x_{6,7}$$

$$x_{1,2} \to -\frac{p_{1,3}p_{1,4}(f_{6,7}p_{2,7}p_{3,1}p_{3,4}p_{4,3}p_{4,5}p_{4,6}(p_{5,4}p_{6,4}+p_{5,6}(p_{6,4}+p_{6,5}))+(-f_{7,2}p_{2,7}p_{3,2}(p_{3,1}p_{4,3}p_{4,5}p_{4,6}(p_{5,4}+p_{5,6})+p_{3,4}(p_{4,3}p_{4,5}p_{4,}}{p_{2,7}(p_{1,2}p_{3,1}p_{3,4}(p_{1,3}p_{4,1}(p_{4,5}p_{4,6}(p_{5,4}+p_{5,6}}$$

$$x_{1,3} \to -\frac{p_{1,2}p_{1,4}(f_{6,7}p_{2,7}p_{3,1}p_{3,4}p_{4,3}p_{4,5}p_{4,6}(p_{5,4}p_{6,4}+p_{5,6}(p_{6,4}+p_{6,5}))+(-f_{7,2}p_{2,7}p_{3,2}(p_{3,1}p_{4,3}p_{4,5}p_{4,6}(p_{5,4}+p_{5,6})+p_{3,4}(p_{4,3}p_{4,5}p_{4,}}{p_{2,7}(p_{1,2}p_{3,1}p_{3,4}(p_{1,3}p_{4,1}(p_{4,5}p_{4,6}(p_{5,4}+p_{5,6}}$$

$$x_{1,4} \to -\frac{p_{1,2}p_{1,3}(f_{6,7}p_{2,7}p_{3,1}p_{3,4}p_{4,3}p_{4,5}p_{4,6}(p_{5,4}p_{6,4}+p_{5,6}(p_{6,4}+p_{6,5}))+(-f_{7,2}p_{2,7}p_{3,2}(p_{3,1}p_{4,3}p_{4,5}p_{4,6}(p_{5,4}+p_{5,6})+p_{3,4}(p_{4,3}p_{4,5}p_{4,}}{p_{2,7}(p_{1,2}p_{3,1}p_{3,4}(p_{1,3}p_{4,1}(p_{4,5}p_{4,6}(p_{5,4}+p_{5,6}}$$

$$x_{4,1} \to -\frac{p_{4,3}p_{4,5}p_{4,6}(f_{6,7}p_{2,7}(p_{1,2}(p_{1,3}+p_{1,4})p_{3,1}+p_{1,3}p_{1,4}(p_{3,1}+p_{3,2}))p_{3,4}(}{p_{2,7}(p_{1,2}p_{3,1}p_{3,4}(p_{1,3}p_{4,1}(p_{4,5}p_{4,6}(p_{5,4}+p_{5,6})+p_{4,3}(p_{4,6}p_{5,4}+p_{4,5}(p_{5,4}+p_{5,6})))+p_{1,4}(p_{4,3}p_{4,5}p_{4,6}(p_{5,4}+p_{5,6})+p_{4,1}(p_{4,5}p_{4,6}(}$$

$$x_{3,4} \to -\frac{p_{3,1}p_{3,2}(-f_{6,7}p_{1,3}p_{1,4}p_{2,7}p_{4,3}p_{4,5}p_{4,6}(p_{5,4}p_{6,4}+p_{5,6}(p_{6,4}+p_{6,5}))+(-f_{7,2}p_{2,7}(p_{1,3}p_{1,4}(p_{4,3}p_{4,5}p_{4,6}(p_{5,4}+p_{5,6})+p_{4,1}(p_{4,5}p_{4,6}}{p_{2,7}(p_{1,2}p_{3,1}p_{3,4}(p_{1,3}}$$

$$x_{4,3} \to -\frac{p_{4,1}p_{4,5}p_{4,6}(f_{6,7}p_{2,7}(p_{1,2}(p_{1,3}+p_{1,4})p_{3,1}+p_{1,3}p_{1,4}(p_{3,1}+p_{3,2}))p_{3,4}(}{p_{2,7}(p_{1,2}p_{3,1}p_{3,4}(p_{1,3}p_{4,1}(p_{4,5}p_{4,6}(p_{5,4}+p_{5,6})+p_{4,3}(p_{4,6}p_{5,4}+p_{4,5}(p_{5,4}+p_{5,6})))+p_{1,4}(p_{4,3}p_{4,5}p_{4,6}(p_{5,4}+p_{5,6})+p_{4,1}(p_{4,5}p_{4,6}(}$$

$$x_{4,5} \to -\frac{p_{4,1}p_{4,3}p_{4,6}(f_{6,7}p_{2,7}(p_{1,2}(p_{1,3}+p_{1,4})p_{3,1}+p_{1,3}p_{1,4}(p_{3,1}+p_{3,2}))p_{3,4}(}{p_{2,7}(p_{1,2}p_{3,1}p_{3,4}(p_{1,3}p_{4,1}(p_{4,5}p_{4,6}(p_{5,4}+p_{5,6})+p_{4,3}(p_{4,6}p_{5,4}+p_{4,5}(p_{5,4}+p_{5,6})))+p_{1,4}(p_{4,3}p_{4,5}p_{4,6}(p_{5,4}+p_{5,6})+p_{4,1}(p_{4,5}p_{4,6}(}$$

$$x_{5,4} \to -\frac{p_{5,6}(f_{6,7}p_{2,7}(p_{1,2}p_{3,1}p_{3,4}(p_{1,3}p_{4,1}(p_{4,5}p_{4,6}p_{6,5}+p_{4,3}(p_{4,5}p_{6,5}+p_{4,6}(p_{6,4}+p_{6,5})))+p_{1,4}(p_{4,3}p_{4,5}p_{4,6}p_{6,5}+p_{4,1}(p_{4,5}p_{4,6}p_{6,5}+p_{4}}{p_{2,7}(p_{1,2}p_{3,1}p_{3,4}(p_{1,3}p_{4,1}(p_{4,5}p_{4,6}(p_{5,4}+p_{5,6})+p_{4,3}(p_{4,6}p_{5,4}+p_{4,5}(p_{5,4}+p_{5,6})))+p_{1,4}(p_{4,3}p_{4,5}p_{4,6}(p_{5,4}+p_{5,6})+p_{4,1}(p_{4,5}p_{4,6}(}$$

“eq test:”

Simplify[balanceEqs/.ξ → 7/.*s*/.xcp]

Simplify[(dopEq/.*s*)/.xcp]

eq test:

{True, True, True, True, True, True, True}

{True, True, True, True, True, True, True, True}