Листинг 2

In[1]:=
```
ClearAll["Global`*"]
SetDirectory[NotebookDirectory[]];
Needs["FlowSolver`"]
```

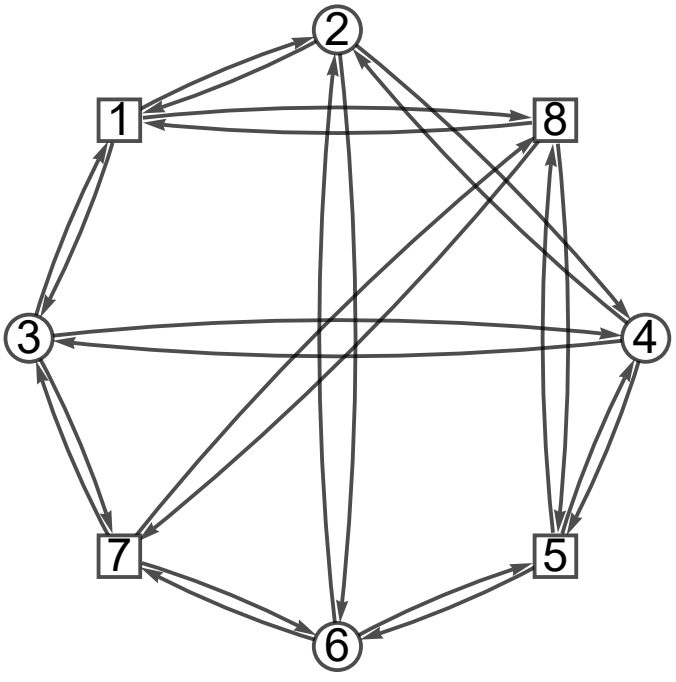
In[4]:=
```
readGraph2[file_, dir_] := Module[{
    fn = FileNameJoin[{dir, file}],
    stream, imod, umod, u, b
    },
    stream = OpenRead[fn];
    imod = Read[stream, {Word, Number}][[2]];
    umod = Read[stream, {Word, Number}][[2]];

  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, Expression}, imod];
  {Graph[u, VertexSize -> Medium, VertexLabels → Placed["Name", Center],
    VertexStyle → Directive[White],
    VertexShapeFunction → {xx_ :> If[SameQ[b[[xx]], x], "Square", "Circle"]},
    VertexLabelStyle -> Directive[Black, 24], GraphLayout -> "CircularEmbedding"], b}]
```

In[5]:=
```
forma[ff_] := ((ff /. {ξ_u_↔v_ → ξu,v}) // TableForm)
```

In[18]:=
```
{g, b} = readGraph2["gr.txt", NotebookDirectory[]];
GraphPlot[g, EdgeStyle → Directive[Black, Thick],
 VertexStyle → Directive[EdgeForm[Thick], White], MultiedgeStyle → .05]
```

Out[19]=



In[20]:=
```
balanceEqs = ((Total[x_# & /@ EdgeList[g, _ ↔ #]] - Total[x_# & /@ EdgeList[g, # ↔ _]])) ==
      MapIndexed[#1 /. x → x_#2[[1]] &, b][[#]] & /@ VertexList[g];
balanceEqs //
 forma
```

Out[21]//TableForm=

$$-x_{1,2} - x_{1,3} - x_{1,8} + x_{2,1} + x_{3,1} + x_{8,1} == x_1$$
$$x_{1,2} - x_{2,1} - x_{2,4} - x_{2,6} + x_{4,2} + x_{6,2} == 0$$
$$x_{1,8} + x_{5,8} + x_{7,8} - x_{8,1} - x_{8,5} - x_{8,7} == x_8$$
$$x_{1,3} - x_{3,1} - x_{3,4} - x_{3,7} + x_{4,3} + x_{7,3} == 0$$
$$x_{2,4} + x_{3,4} - x_{4,2} - x_{4,3} - x_{4,5} + x_{5,4} == 0$$
$$x_{2,6} + x_{5,6} - x_{6,2} - x_{6,5} - x_{6,7} + x_{7,6} == 0$$
$$x_{4,5} - x_{5,4} - x_{5,6} - x_{5,8} + x_{6,5} + x_{8,5} == x_5$$
$$x_{3,7} + x_{6,7} - x_{7,3} - x_{7,6} - x_{7,8} + x_{8,7} == x_7$$

In[22]:=
```
{p_1↔2 = 1/4, p_2↔1 = 2/5,
 p_1↔8 = 1/2, p_8↔1 = 1/6,
 p_1↔3 = 1/4, p_3↔1 = 2/7,
 p_2↔4 = 1/5, p_4↔2 = 3/5,
 p_2↔6 = 2/5, p_6↔2 = 1/8,
 p_8↔5 = 1/2, p_5↔8 = 1/5,
 p_8↔7 = 1/3, p_7↔8 = 1/3,
 p_4↔5 = 1/5, p_5↔4 = 3/5,
 p_4↔3 = 1/5, p_3↔4 = 2/7,
 p_5↔6 = 1/5, p_6↔5 = 3/8,
 p_6↔7 = 1/2, p_7↔6 = 1/3,
 p_7↔3 = 1/3, p_3↔7 = 3/7}
```

Out[22]= $\left\{\frac{1}{4}, \frac{2}{5}, \frac{1}{2}, \frac{1}{6}, \frac{1}{4}, \frac{2}{7}, \frac{1}{5}, \frac{3}{5}, \frac{2}{5}, \frac{1}{8}, \frac{1}{2}, \frac{1}{5}, \frac{1}{3}, \frac{1}{3}, \frac{1}{5}, \frac{3}{5}, \frac{1}{5}, \frac{2}{7}, \frac{1}{5}, \frac{3}{8}, \frac{1}{2}, \frac{1}{3}, \frac{1}{3}, \frac{3}{7}\right\}$

In[23]:=
```
M = {8};
Print["M = ", M];
```

```
M = {8}
```

In[25]:=
```
(*incL=
 DeleteCases[DeleteDuplicates[Cases[IncidenceList[g,#],i_↔j_:>{i,j}]//Flatten],
    v_/;v==#]&/@M*)
incL = (IncidenceList[g, #] & /@ M) // Flatten
```

Out[25]= $\{1 \leftrightarrow 8, 8 \leftrightarrow 1, 8 \leftrightarrow 5, 5 \leftrightarrow 8, 8 \leftrightarrow 7, 7 \leftrightarrow 8\}$

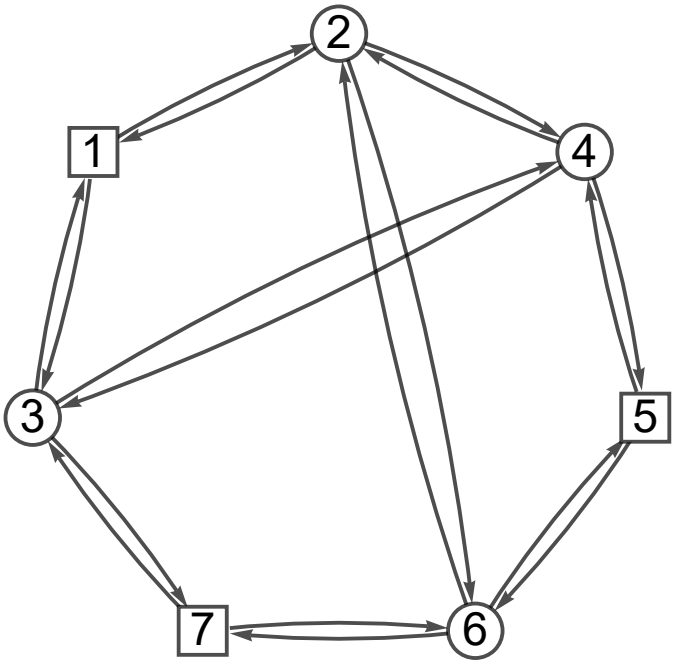
In[27]:=
```
(f_# & /@ incL)
```

In[29]:=
```
{f_1↔8, f_8↔1, f_8↔5, f_5↔8, f_8↔7, f_7↔8} = {1, 2, 1, 3, 1, 2}
```

Out[29]= $\{1, 2, 1, 3, 1, 2\}$

In[30]:=
```
(*Do[If[MemberQ[M,j[[1]]],b[[j[[2]]]]+=f_j,b[[j[[1]]]]-=f_j],{j,incL}]*)
b̄ = Fold[If[MemberQ[M, #2[[1]]], ReplacePart[#, #2[[2]] → #[[#2[[2]]]] + f_#2],
      ReplacePart[#, #2[[1]] → #[[#2[[1]]]] - f_#2]] &, b, incL];
b̄ = Delete[b̄, #] &@@ M;
n̄ḡ = VertexDelete[g, M];
GraphPlot[n̄ḡ, EdgeStyle → Directive[Black, Thick],
 VertexStyle → Directive[EdgeForm[Thick], White], MultiedgeStyle → .05]
b̄
```

Out[33]=



Out[34]= $\{1+x, 0, 0, 0, -2+x, 0, -1+x\}$

In[35]:=
```
CC[g_, M_] :=
  (DeleteDuplicates[Cases[IncidenceList[g, #], i_ ↔ j_ /; j == #]] &/@ M) // Flatten

ii_i_[g_] := Cases[IncidenceList[g, i], u_ ↔ v_ /; u == i :> v]
```

In[37]:=
```
M⁺ = CC[g, M]
```

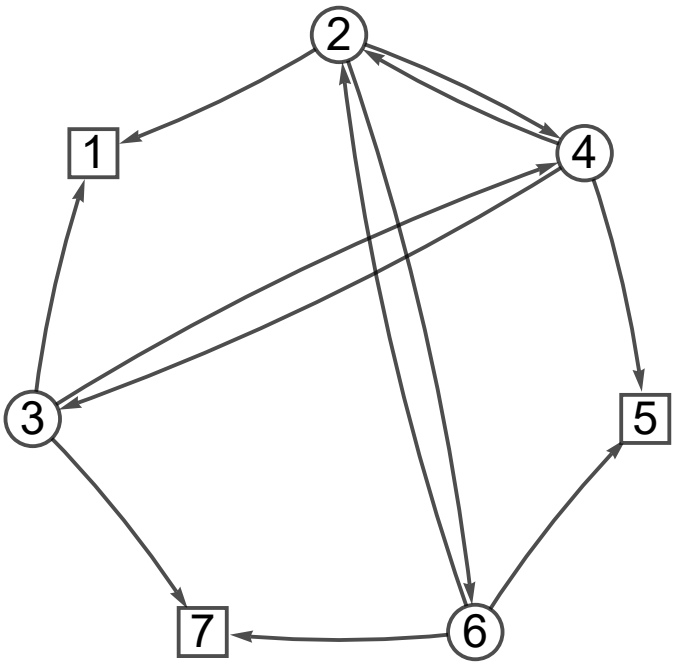
Out[37]= $\{1 \leftrightarrow 8, 5 \leftrightarrow 8, 7 \leftrightarrow 8\}$

In[38]:=
```
b1̄ = Fold[Module[{bb = #1, i = #2[[1,1]], k = #2[[2,1]]},
     (ReplacePart[bb, (({{# → bb[[#]] + p_{i↔#}/p_{i↔k} f_{i↔k}, i → bb[[i]] - p_{i↔#}/p_{i↔k} f_{i↔k}}) &) /@ ii_i[n̄ḡ]] //
       Flatten]) &, b̄, M⁺]
```

Out[38]= $\left\{\frac{1}{2}+x, \frac{1}{2}, \frac{5}{2}, 9, -11+x, 5, -3+x\right\}$

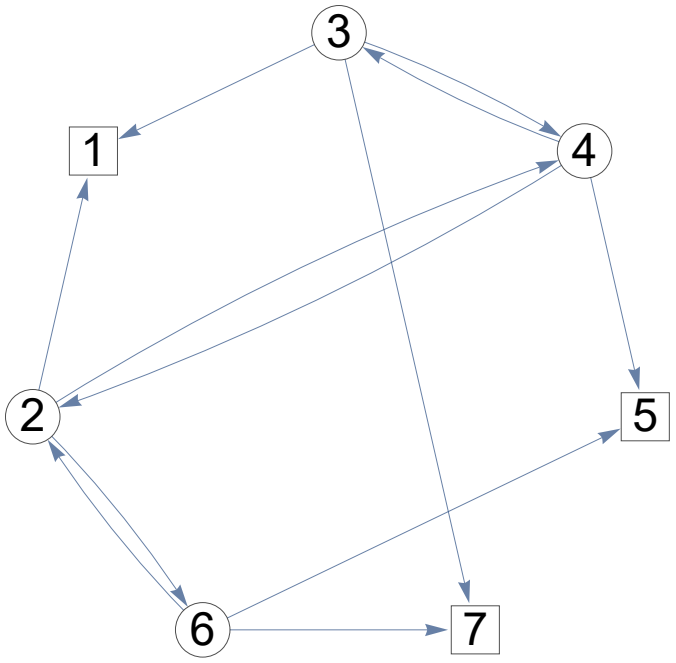
In[39]:=
```
GraphPlot[Fold[HighlightGraph[#1, u_ ↦ v_ /; u == #2, GraphHighlightStyle → "White"] &,
  ng, #[[1]] & /@ M+], EdgeStyle → Directive[Black, Thick],
 VertexStyle → Directive[EdgeForm[Thick], White], MultiedgeStyle → .05]
```

Out[39]=



In[40]:=
```
g1 = Fold[EdgeDelete[#1, u_ ↦ v_ /; u == #2] &, ng, #[[1]] & /@ M+];
GraphPlot[g1, MultiedgeStyle → .05]
```

Out[41]=



In[42]:=
```
IIrem = VertexList[g1] ~Complement~ (M+[[All, 1]])
```

Out[42]=
```
{2, 3, 4, 6}
```

In[67]:=
```
λ = SparseArray[
  Replace[(EdgeList[g1] /. # & /@ Flatten[Module[{i = #, jf, Icur},
      (Icur = ii[g1];
       jf = First[Icur];
       ({(i ↔ jf) → 1, (i ↔ #) → -p_{i↔#}/p_{i↔jf}} & /@ Icur[[2 ;;]])] & /@ II_rem, 1]),
   _ ↔ _ → 0, 2]]
```

Out[67]=
```
SparseArray[  ]
```
Specified elements: 16
Dimensions: {8, 12}

In[44]:=
```
Grid[λ]
```

Out[44]=

1	0	$-\frac{1}{2}$	0	0	0	0	0	0	0	0	0
1	0	0	0	−1	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0	−1	0	0	0
0	1	0	0	0	0	0	0	0	0	0	$-\frac{3}{2}$
0	0	0	1	0	0	$-\frac{1}{3}$	0	0	0	0	0
0	0	0	1	0	0	0	$-\frac{1}{3}$	0	0	0	0
0	0	0	0	0	1	0	0	0	−3	0	0
0	0	0	0	0	1	0	0	0	0	−4	0

In[45]:=
```
g = g1;
b = b1;
```

In[47]:=
```
II* = Cases[MapIndexed[{#1, #2} &, b], {el_, i_} /; MemberQ[el, x] :> i] // Flatten
```

Out[47]=
```
{1, 5, 7}
```

In[48]:=
```
buildt = Timing[{t, g} = buildTree[g, II*];][[1]]
TableForm[t[[1 ;; 4]],
 TableHeadings → {{"pred", "dir", "depth", "d"}, t // pred // Length // Range}]
```

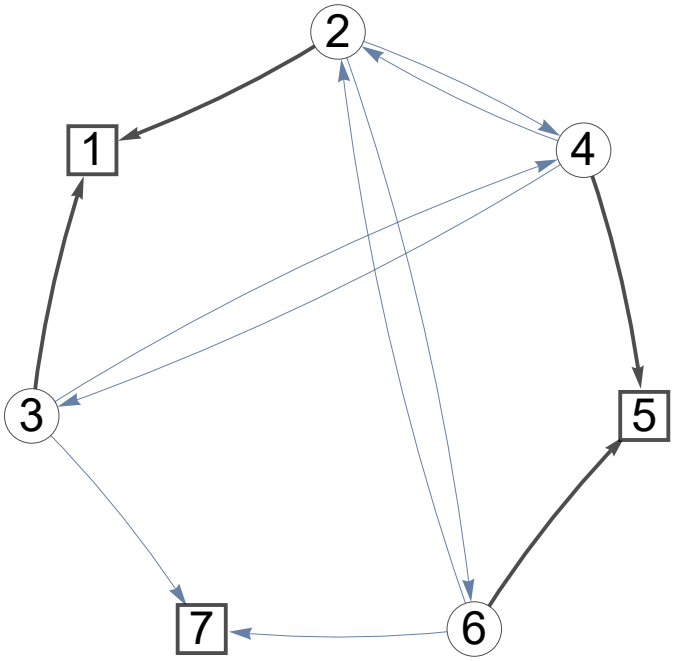
Out[48]=
```
0.
```

Out[49]//TableForm=

	1	2	3	4	5	6	7	8
pred	8	1	1	5	8	5	8	0
dir	1	−1	−1	−1	1	−1	1	0
depth	1	2	2	2	1	2	1	0
d	2	3	5	6	4	7	8	1

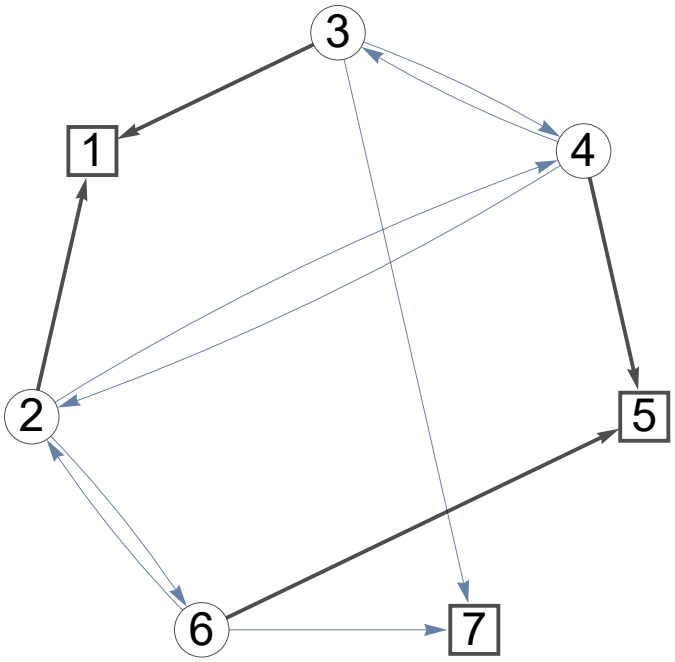
In[50]:=
```
GraphPlot[HighlightGraph[
  Fold[HighlightGraph[#1, Style[u_ ↔ v_ /; u == #2, White]] &, ng, #[[1]] & /@ M^+],
  {Style[u_ /; VertexQ[g, u] && pred[t][[u]] == root[t], EdgeForm[Thick]],
   Style[u_ ↔ v_ /; (pred[t][[u]] == v && dir[t][[u]] == -1) ||
      (pred[t][[v]] == u && dir[t][[v]] == 1), Directive[Black, Thick]]},
  GraphHighlightStyle → None], MultiedgeStyle → .05]
```

Out[50]=



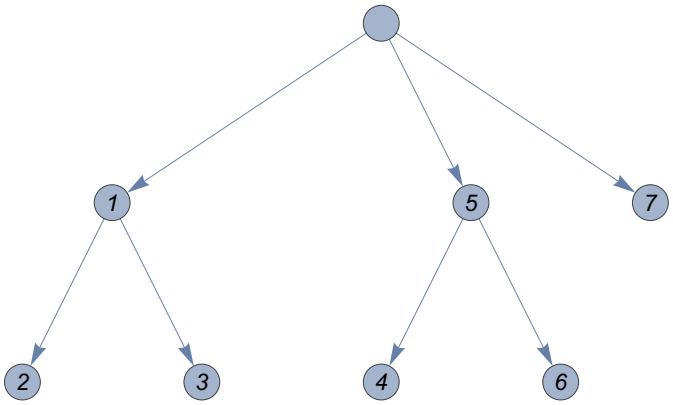
In[51]:=
```
GraphPlot[HighlightGraph[g1,
  {Style[u_ /; VertexQ[g, u] && pred[t][[u]] == root[t], EdgeForm[Thick]],
   Style[u_ ↔ v_ /; (pred[t][[u]] == v && dir[t][[u]] == -1) ||
      (pred[t][[v]] == u && dir[t][[v]] == 1), Directive[Black, Thick]]},
  GraphHighlightStyle → None], MultiedgeStyle → .05]
```

Out[51]=



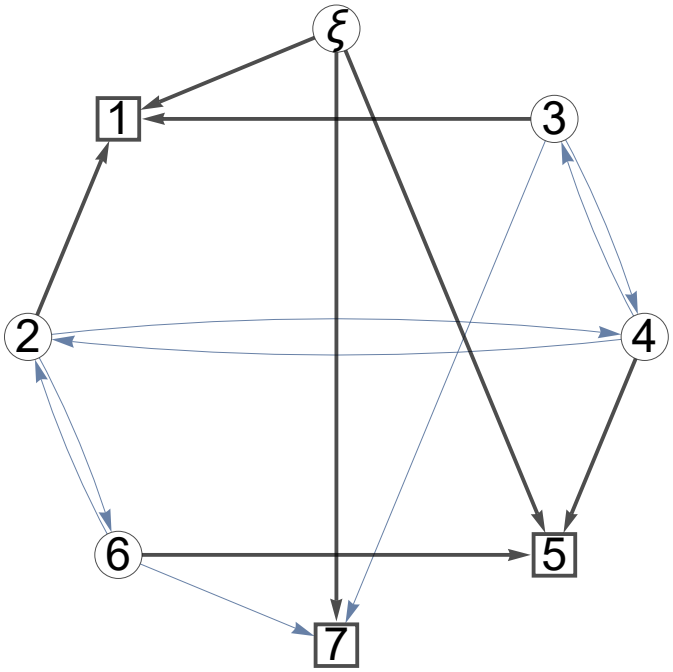
In[52]:=
```
t[[7]](*пометить на графе*)
```

Out[52]=



In[53]:=
```
(*GraphPlot[g,MultiedgeStyle→.05]*)
GraphPlot[HighlightGraph[g,
  {Style[u_ /; VertexQ[g, u] && pred[t][[u]] == root[t], EdgeForm[Thick]],
   Style[u_ ↔ v_ /; (pred[t][[u]] == v && dir[t][[u]] == -1) ||
      (pred[t][[v]] == u && dir[t][[v]] == 1), Directive[Black, Thick]]},
  GraphHighlightStyle → None], MultiedgeStyle → .05]
```

Out[53]=



In[54]:=
```
AppendTo[b, -Total[b]];
b = Simplify[b /. x → 0]
```

Out[55]=
$$\left\{\frac{1}{2}, \frac{1}{2}, \frac{5}{2}, 9, -11, 5, -3, -\frac{7}{2}\right\}$$

In[56]:=
```
balanceEqs = ((Total[x_# & /@ EdgeList[g, _ ↔ #]] - Total[x_# & /@ EdgeList[g, # ↔ _]]) /.
        root[t] → ξ) == b[[#]] & /@ VertexList[g];
balanceEqs //
 forma
```

Out[57]//TableForm=

$$x_{2,1} + x_{3,1} + x_{\xi,1} == \frac{1}{2}$$
$$-x_{2,1} - x_{2,4} - x_{2,6} + x_{4,2} + x_{6,2} == \frac{1}{2}$$
$$-x_{3,1} - x_{3,4} - x_{3,7} + x_{4,3} == \frac{5}{2}$$
$$x_{2,4} + x_{3,4} - x_{4,2} - x_{4,3} - x_{4,5} == 9$$
$$x_{2,6} - x_{6,2} - x_{6,5} - x_{6,7} == 5$$
$$x_{4,5} + x_{6,5} + x_{\xi,5} == -11$$
$$x_{3,7} + x_{6,7} + x_{\xi,7} == -3$$
$$-x_{\xi,1} - x_{\xi,5} - x_{\xi,7} == -\frac{7}{2}$$

In[58]:=
```
ps = partSolve[g, -b, t, x̃];
ps // forma
```

Out[59]//TableForm=

$$\tilde{x}_{2,1} \to -\frac{1}{2}$$
$$\tilde{x}_{2,4} \to 0$$
$$\tilde{x}_{2,6} \to 0$$
$$\tilde{x}_{3,1} \to -\frac{5}{2}$$
$$\tilde{x}_{3,4} \to 0$$
$$\tilde{x}_{3,7} \to 0$$
$$\tilde{x}_{4,2} \to 0$$
$$\tilde{x}_{4,3} \to 0$$
$$\tilde{x}_{4,5} \to -9$$
$$\tilde{x}_{6,2} \to 0$$
$$\tilde{x}_{6,5} \to -5$$
$$\tilde{x}_{6,7} \to 0$$
$$\tilde{x}_{8,1} \to \frac{7}{2}$$
$$\tilde{x}_{8,5} \to 3$$
$$\tilde{x}_{8,7} \to -3$$

In[60]:=
```
Simplify[(balanceEqs /. {x → x̃, ξ → root[t]}) /. ps]
```

Out[60]= {True, True, True, True, True, True, True, True}

In[61]:=
```
matrt = Timing[δMatr = δ1[g, t]];
rootт = VertexCount[g];
TableForm[δMatr, TableHeadings → {uNb[g, t], δ[#[[2]] & /@ Select[EdgeList[g], #[[1]] == rootт &]]}] // forma
```

Out[63]//TableForm=

	$\delta_{2,1}$	$\delta_{3,1}$	$\delta_{2,4}$	$\delta_{4,2}$	$\delta_{2,6}$	$\delta_{6,2}$	$\delta_{4,5}$	$\delta_{4,3}$	$\delta_{3,4}$	$\delta_{6,5}$	$\delta_{6,7}$
$2 \leftrightarrow 4$	-1	0	1	0	0	0	1	0	0	0	0
$4 \leftrightarrow 2$	1	0	0	1	0	0	-1	0	0	0	0
$2 \leftrightarrow 6$	-1	0	0	0	1	0	0	0	0	1	0
$6 \leftrightarrow 2$	1	0	0	0	0	1	0	0	0	-1	0
$4 \leftrightarrow 3$	0	1	0	0	0	0	-1	1	0	0	0
$3 \leftrightarrow 4$	0	-1	0	0	0	0	1	0	1	0	0
$6 \leftrightarrow 7$	0	0	0	0	0	0	0	0	0	-1	1
$3 \leftrightarrow 7$	0	-1	0	0	0	0	0	0	0	0	0

In[68]:=
```
λ = SparseArray[λ, {Length[λ], Length[λ[[1]]] + 3}];
(*λ=λ[[;;-2]]*)
```

In[69]:=
```
dopEq = # == 0 & /@ Flatten[λ.{x# & /@ EdgeList[g]}^T];
dopEq // forma
```

Out[70]//TableForm=

$$x_{2,1} - \frac{x_{2,4}}{2} == 0$$
$$x_{2,1} - x_{2,6} == 0$$
$$x_{3,1} - x_{3,4} == 0$$
$$x_{3,1} - \frac{3\,x_{3,7}}{2} == 0$$
$$x_{4,2} - \frac{x_{4,5}}{3} == 0$$
$$x_{4,2} - \frac{x_{4,3}}{3} == 0$$
$$x_{6,2} - 3\,x_{6,5} == 0$$
$$x_{6,2} - 4\,x_{6,7} == 0$$

In[71]:=
```
Λ = λ.(δMatr)^T;
"cicle det's:"
Λ // forma
```

Out[72]= cicle det's:

Out[73]//TableForm=

$$\begin{array}{cccccccc}
-\frac{3}{2} & 1 & -1 & 1 & 0 & 0 & 0 & 0 \\
-1 & 1 & -2 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & -2 & 0 & -1 \\
0 & 0 & 0 & 0 & 1 & -1 & 0 & -\frac{5}{2} \\
-\frac{1}{3} & \frac{4}{3} & 0 & 0 & \frac{1}{3} & -\frac{1}{3} & 0 & 0 \\
0 & 1 & 0 & 0 & -\frac{1}{3} & 0 & 0 & 0 \\
0 & 0 & -3 & 4 & 0 & 0 & 3 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & -4 & 0
\end{array}$$

In[78]:=
```
"Uc="
Uc = Range[8]
"Unc="
Unc = {}
```

Out[78]= $U_c =$

Out[79]= {1, 2, 3, 4, 5, 6, 7, 8}

Out[80]= $U_{nc} =$

Out[81]= { }

In[82]:=
```
Λc = Λ[[All, Uc]];
Λnc = Λ[[All, Unc]];
"Λc="
Λc // MatrixForm
```

Out[84]= $\Lambda_c =$

Out[85]//MatrixForm=

$$\begin{pmatrix}
-\frac{3}{2} & 1 & -1 & 1 & 0 & 0 & 0 & 0 \\
-1 & 1 & -2 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & -2 & 0 & -1 \\
0 & 0 & 0 & 0 & 1 & -1 & 0 & -\frac{5}{2} \\
-\frac{1}{3} & \frac{4}{3} & 0 & 0 & \frac{1}{3} & -\frac{1}{3} & 0 & 0 \\
0 & 1 & 0 & 0 & -\frac{1}{3} & 0 & 0 & 0 \\
0 & 0 & -3 & 4 & 0 & 0 & 3 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & -4 & 0
\end{pmatrix}$$

In[86]:=
```
"det(Λc)="
Simplify[det = Det[Λc]] // forma
```

Out[86]= $\det(\Lambda_c) =$

Out[87]//TableForm=

$$-\frac{676}{9}$$

In[88]:=
```
"UT="
utind = Cases[t[[6]], ξ_ /; ξ ≠ 0];
UT = EdgeList[g][[utind]]
```

Out[88]= $U_T =$

Out[90]= $\{8 \leftrightarrow 1,\ 2 \leftrightarrow 1,\ 3 \leftrightarrow 1,\ 4 \leftrightarrow 5,\ 8 \leftrightarrow 5,\ 6 \leftrightarrow 5,\ 8 \leftrightarrow 7\}$

In[91]:=
```
"UNb="
UNb = uNb[g, t]
```

Out[91]= $U_{Nb} =$

Out[92]= $\{2 \leftrightarrow 4,\ 4 \leftrightarrow 2,\ 2 \leftrightarrow 6,\ 6 \leftrightarrow 2,\ 4 \leftrightarrow 3,\ 3 \leftrightarrow 4,\ 6 \leftrightarrow 7,\ 3 \leftrightarrow 7\}$

In[93]:=
```
A = -λ.{x̃# & /@ EdgeList[g]}^T /. ps;
"A="
A // MatrixForm
```

Out[94]= $A =$

Out[95]//MatrixForm=

$$\begin{pmatrix} \frac{1}{2} \\ \frac{1}{2} \\ \frac{5}{2} \\ \frac{5}{2} \\ -3 \\ 0 \\ -15 \\ 0 \end{pmatrix}$$

In[96]:=
```
β = A - Λnc.{x# & /@ UNb[[Unc]]}^T;
"β="
β // forma
```

Out[97]= $\beta =$

Out[98]//TableForm=

$$\frac{1}{2}$$
$$\frac{1}{2}$$
$$\frac{5}{2}$$
$$\frac{5}{2}$$
$$-3$$
$$0$$
$$-15$$
$$0$$

In[99]:=
```
"решаем уравнение Λc xc=β:"
xc = LinearSolve[Λc, β]
```

Out[99]= решаем уравнение $\Lambda_c x_c = \beta$:

Out[100]= $\left\{\left\{-\frac{4777}{1352}\right\}, \left\{-\frac{775}{338}\right\}, \left\{-\frac{4777}{2704}\right\}, \left\{-\frac{2889}{676}\right\}, \left\{-\frac{2325}{338}\right\}, \left\{-\frac{4755}{1352}\right\}, \left\{-\frac{2889}{2704}\right\}, \left\{-\frac{1585}{676}\right\}\right\}$

In[101]:=
```
xcp = MapThread[x#1 → #2 &, {UNb[[Uc]], Flatten[xc]}];
xcp // TableForm
```

Out[102]//TableForm=

$$x_{2\bullet\to4} \to -\frac{4777}{1352}$$
$$x_{4\bullet\to2} \to -\frac{775}{338}$$
$$x_{2\bullet\to6} \to -\frac{4777}{2704}$$
$$x_{6\bullet\to2} \to -\frac{2889}{676}$$
$$x_{4\bullet\to3} \to -\frac{2325}{338}$$
$$x_{3\bullet\to4} \to -\frac{4755}{1352}$$
$$x_{6\bullet\to7} \to -\frac{2889}{2704}$$
$$x_{3\bullet\to7} \to -\frac{1585}{676}$$

In[103]:=
```
s = solveAll[g, t];
s // TableForm
```

Out[104]//TableForm=

$$x_{2\bullet\to1} \to -\frac{1}{2} - x_{2\bullet\to4} - x_{2\bullet\to6} + x_{4\bullet\to2} + x_{6\bullet\to2}$$
$$x_{3\bullet\to1} \to -\frac{5}{2} - x_{3\bullet\to4} - x_{3\bullet\to7} + x_{4\bullet\to3}$$
$$x_{4\bullet\to5} \to -9 + x_{2\bullet\to4} + x_{3\bullet\to4} - x_{4\bullet\to2} - x_{4\bullet\to3}$$
$$x_{6\bullet\to5} \to -5 + x_{2\bullet\to6} - x_{6\bullet\to2} - x_{6\bullet\to7}$$
$$x_{8\bullet\to1} \to \frac{7}{2} + x_{2\bullet\to4} + x_{2\bullet\to6} + x_{3\bullet\to4} + x_{3\bullet\to7} - x_{4\bullet\to2} - x_{4\bullet\to3} - x_{6\bullet\to2}$$
$$x_{8\bullet\to5} \to 3 - x_{2\bullet\to4} - x_{2\bullet\to6} - x_{3\bullet\to4} + x_{4\bullet\to2} + x_{4\bullet\to3} + x_{6\bullet\to2} + x_{6\bullet\to7}$$
$$x_{8\bullet\to7} \to -3 - x_{3\bullet\to7} - x_{6\bullet\to7}$$

In[105]:=
```
"общее решение:"
xsol = ((s /. xcp) ~Join~ xcp);
xsol /. {ξ_u_↔v_ → ξu,v} // Simplify // TableForm
```

Out[105]= общее решение:

Out[107]//TableForm=

$$x_{2,1} \to -\frac{4777}{2704}$$
$$x_{3,1} \to -\frac{4755}{1352}$$
$$x_{4,5} \to -\frac{2325}{338}$$
$$x_{6,5} \to -\frac{963}{676}$$
$$x_{8,1} \to \frac{1203}{208}$$
$$x_{8,5} \to -\frac{1823}{676}$$
$$x_{8,7} \to \frac{1117}{2704}$$
$$x_{2,4} \to -\frac{4777}{1352}$$
$$x_{4,2} \to -\frac{775}{338}$$
$$x_{2,6} \to -\frac{4777}{2704}$$
$$x_{6,2} \to -\frac{2889}{676}$$
$$x_{4,3} \to -\frac{2325}{338}$$
$$x_{3,4} \to -\frac{4755}{1352}$$
$$x_{6,7} \to -\frac{2889}{2704}$$
$$x_{3,7} \to -\frac{1585}{676}$$

In[108]:=
```
"eq test:"
Simplify[balanceEqs /. ξ → root[t] /. s /. xcp]
Simplify[(dopEq /. s) /. xcp]
```

Out[108]= eq test:

Out[109]= {True, True, True, True, True, True, True, True}

Out[110]= {True, True, True, True, True, True, True, True}