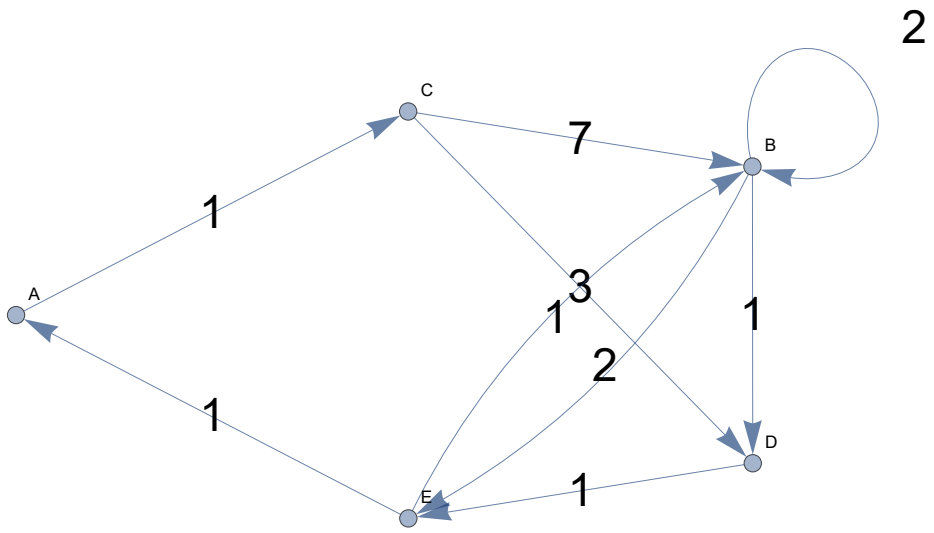
```
gr = ConstantArray[∞, {5, 5}];
gr[[1, 3]] = 1;
gr[[2, 2]] = 2;
gr[[2, 4]] = 1;
gr[[2, 5]] = 2;
gr[[3, 2]] = 7;
gr[[3, 4]] = 3;
gr[[4, 5]] = 1;
gr[[5, 1]] = 1;
gr[[5, 2]] = 1;
WeightedAdjacencyGraph[gr,
 VertexLabels → {1 → "A", 2 → "B", 3 → "C", 4 → "D", 5 → "E"},
 DirectedEdges → True, EdgeLabels → "EdgeWeight", EdgeLabelStyle → Large]
```




Notes:

Format for rectangle obj: {*x*, *y*, *L*, *d*}

{*x*, *y*} - lower left fill coordinate of rectangle (minimum coordinate is {1, 1})

*L* - length of rectangle

*d* - type of rectangle (“h” - horizontal, “v” - vertical, “u” - unit square)

Solution rectangle to be specified as a solution function argument

In[25]:=
```
SetDirectory[NotebookDirectory[]];
getrectg[rect_, sol_: False] := Block[{c1 = rect[[1 ;; 2]] - {1, 1},
     c2 = Switch[rect[[4]], "h", rect[[1 ;; 2]] + {rect[[3]] - 1, 0},
       "v", rect[[1 ;; 2]] + {0, rect[[3]] - 1}, "u", rect[[1 ;; 2]]]},
    {If[sol, Red, Brown], EdgeForm[Directive[Thick, Black]],
     Rectangle[c1, c2], Directive[Thick, Black], Text["", (c1 + c2)/2]}];
getrectgls[rectls_, sols_] := Block[{ls = getrectg /@ rectls, i},
   ls[[sols, 1]] = Red;
```

```
    For[i = 1, i ≤ Length[rectls], ++i,
     ls[[i, -1, 1]] = Style[ToString[i], Bold, Large]];
    Return[Join @@ ls];];
getborder[gs_] := {Directive[Thick, Black],
    Line[{{0, 0}, {0, gs[[2]]}, gs, {gs[[1]], 0}, {0, 0}}]};
getcoords[gs_, srect_, s_] := Switch[srect[[4]], "h",
    If[s == -1, {{0, srect[[2]] - 1}, {0, srect[[2]]}},
     {{gs[[1]], srect[[2]] - 1}, {gs[[1]], srect[[2]]}}],
    "v", If[s == -1, {{srect[[1]] - 1, 0}, {srect[[1]], 0}},
     {{srect[[1]] - 1, gs[[2]]}, {srect[[1]], gs[[2]]}}], "u",
    Print["ERROR: unit square for solution currently unsupported!"]];
showsystem[gs_, rinfo_, sols_] := Block[{scoords = Table[
       getcoords[gs, rinfo[[sols[[i, 1]]]], sols[[i, 2]]], {i, Length[sols]}]},
    Graphics[Join[getborder[gs], getrectgls[rinfo, sols[[ ;; , 1]]]],
     Epilog → (Style[Line[#], Thickness[0.015], Red] & /@ scoords)]];
getoccupancymatrix[gs_, rinfo_] := Block[{mat = ConstantArray[0, gs], i, t},
    For[i = 1, i ≤ Length[rinfo], ++i, t = rinfo[[i]];
     Switch[t[[4]], "h", mat[[t[[1]] ;; t[[1]] + t[[3]] - 1, t[[2]]]] = 1, "v", mat[[
        t[[1]], t[[2]] ;; t[[2]] + t[[3]] - 1]] = 1, "u", mat[[t[[1]], t[[2]]]] = 1];];
    Return[mat];];
showoccupancy[occ_] := MatrixPlot[Transpose@occ, DataReversed → {True, False}];
shiftrect[rect_, shift_] :=
  {rect[[1]] + shift[[1]], rect[[2]] + shift[[2]], rect[[3]], rect[[4]]};
calcspace[arr_, asc_] := Block[{i, n = Length[arr]}, If[n == 0, Return[0]];
    If[asc, For[i = 1, i ≤ n, ++i, If[arr[[i]] ≠ 0, Return[i - 1]]],
     For[i = n, i ≥ 1, --i, If[arr[[i]] ≠ 0, Return[n - i]]]];
    Return[n];];
FindMoves[rectls_, occ_] :=
 (
  Module[{gs, mvs, t, i, l, r, c, s},
    gs = Dimensions[occ];
    mvs = {};
    For[i = 1, i ≤ Length[rectls], ++i,
     t = rectls[[i]];
     Switch[t[[4]], "h",
      (* Block with fixed y-value c, x-value [l,r] *)
      c = t[[2]];
      l = t[[1]];
      r = l + t[[3]] - 1;
      (* Calculate space on the left *)
      s = If[l > 1, calcspace[occ[[1 ;; l - 1, c]], False], 0];
      If[s > 0, mvs = Append[mvs, {i, -s, 0}];];
      (* Calculate space on the right *)
      s = If[r < gs[[1]], calcspace[occ[[r + 1 ;; gs[[1]], c]], True], 0];
      If[s > 0, mvs = Append[mvs, {i, s, 0}];];
      , "v",
```

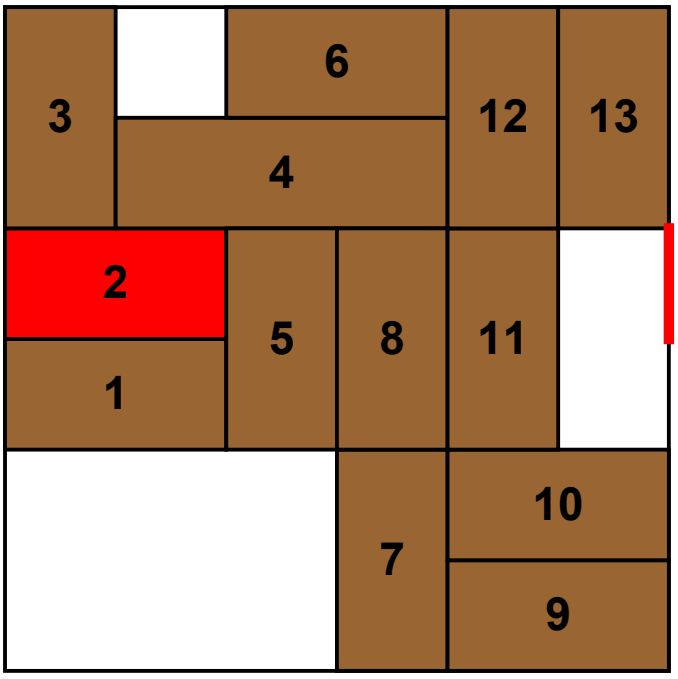
```
      (* Block with fixed x-value c, y-value [l,r] *)
      c = t[[1]];
      l = t[[2]];
      r = l + t[[3]] - 1;
      (* Calculate space on the bottom *)
      s = If[l > 1, calcspace[occ[[c, 1 ;; l - 1]], False], 0];
      If[s > 0, mvs = Append[mvs, {i, 0, -s}];];
      (* Calculate space on the top *)
      s = If[r < gs[[2]], calcspace[occ[[c, r + 1 ;; gs[[2]]]], True], 0];
      If[s > 0, mvs = Append[mvs, {i, 0, s}];];
      , "u",
      (* Unit block *)
      c = t[[2]];
      l = t[[1]];
      (* Calculate space on the left *)
      s = If[l > 1, calcspace[occ[[1 ;; l - 1, c]], False], 0];
      If[s > 0, mvs = Append[mvs, {i, -s, 0}];];
      (* Calculate space on the right *)
      s = If[r < gs[[1]], calcspace[occ[[l + 1 ;; gs[[1]], c]], True], 0];
      If[s > 0, mvs = Append[mvs, {i, s, 0}];];
      c = t[[1]];
      l = t[[2]];
      (* Calculate space on the bottom *)
      s = If[l > 1, calcspace[occ[[c, 1 ;; l - 1]], False], 0];
      If[s > 0, mvs = Append[mvs, {i, 0, -s}];];
      (* Calculate space on the top *)
      s = If[r < gs[[2]], calcspace[occ[[c, l + 1 ;; gs[[2]]]], True], 0];
      If[s > 0, mvs = Append[mvs, {i, 0, s}];];
     ];
    ];
    Return[mvs];
   ];
 )
ApplyMove[rectls_, move_] :=
  Block[{res = rectls}, res[[move[[1]], 1 ;; 2]] += move[[2 ;; 3]];
   Return[res];];
ApplyMovesNested[rectls_, moves_] :=
  Block[{res = {rectls}, i}, For[i = 1, i ≤ Length[moves],
    ++i, res = Append[res, ApplyMove[res[[-1]], moves[[i]]]];];
   Return[res];];
SolutionQ[rectls_, sols_, occ_] := Block[{gs = Dimensions[occ], i, t},
   For[i = 1, i ≤ Length[sols], ++i, t = rectls[[sols[[i, 1]]]];
    Switch[t[[4]], "h", If[sols[[i, 2]] == -1,
      If[calcspace[occ[[1 ;; t[[1]] - 1, t[[2]]]], False] < t[[1]] - 1, Return[
        False]], If[calcspace[occ[[t[[3]] + t[[1]] ;; gs[[1]], t[[2]]]], True] <
        gs[[1]] - t[[3]] - t[[1]] + 1, Return[False]]], "v", If[sols[[i, 2]] == -1,
```

```
      If[calcspace[occ[[t[[1]], 1 ;; t[[2]] - 1]], False] < t[[2]] - 1,
       Return[False]], If[calcspace[occ[[t[[1]], t[[3]] + t[[2]] ;; gs[[2]]]],
         True] < gs[[2]] - t[[3]] - t[[2]] + 1, Return[False]]], "u",
     Print["ERROR: unit square for solution currently unsupported!"]]];
   Return[True];];
GVAR = {};
CT = 0;
T1 = 0; T2 = 0; T3 = 0; T4 = 0; T5 = 0;
FindSolution[gs_, rinfo_, sols_, depth_Integer] :=
  FSRec[gs, rinfo, sols, {}, depth, getoccupancymatrix[gs, rinfo]];
FSRec[gs_, rinfo_, sols_, mvlist_, depth_Integer, occmat_] :=
 (
  Module[{i, curmv, curmvs, mv, rnew, mvlsnew, occnew, t, tn},
    CT = CT + 1;
    (* Check if given state is a solution - otherwise continue *)
    T2 += Timing[If[SolutionQ[rinfo, sols, occmat], GVAR = mvlist;
         Return[True]];][[1]];
    (* Check current depth - if still more than 0, continue *)
    If[depth == 0, Return[False]];
    (* Calculate possible moves *)
    T3 += Timing[curmvs = FindMoves[rinfo, occmat];][[1]];
    (* Remove undesirable moves *)
    (* Case 1 - Backward move *)
    T4 += Timing[
       If[Length[mvlist] > 0,
         mv = Last[mvlist];
         mv[[2 ;; 3]] = -mv[[2 ;; 3]];
         curmvs = DeleteCases[curmvs, mv];
        ];][[1]];
    (* Loop through the new set of moves *)
    For[i = 1, i ≤ Length[curmvs], ++i,
     (* Update rectangle info and move list *)
     mv = curmvs[[i]];
     T5 += Timing[rnew = ApplyMove[rinfo, mv];
        mvlsnew = Append[mvlist, mv];][[1]];
     (* Update occupancy matrix *)
     T1 += Timing[
        t = rinfo[[mv[[1]]]];
        tn = rnew[[mv[[1]]]];
        occnew = occmat;
        Switch[t[[4]], "h", occnew[[t[[1]] ;; t[[1]] + t[[3]] - 1, t[[2]]]] = 0;
         occnew[[tn[[1]] ;; tn[[1]] + tn[[3]] - 1, tn[[2]]]] = 1;,
         "v", occnew[[t[[1]], t[[2]] ;; t[[2]] + t[[3]] - 1]] = 0;
         occnew[[tn[[1]], tn[[2]] ;; tn[[2]] + tn[[3]] - 1]] = 1;,
         "u", occnew[[t[[1]], t[[2]]]] = 0;
         occnew[[tn[[1]], tn[[2]]]] = 1;];
```

```
        ][[1]];
       If[FSRec[gs, rnew, sols, mvlsnew, depth - 1, occnew], Return[True]];
      ];
      Return[False];
     ];
    )
```

In[44]:=
```
gs = {6, 6};
rinfo = {
   {1, 3, 2, "h"},
   {1, 4, 2, "h"},
   {1, 5, 2, "v"},
   {2, 5, 3, "h"},
   {3, 3, 2, "v"},
   {3, 6, 2, "h"},
   {4, 1, 2, "v"},
   {4, 3, 2, "v"},
   {5, 1, 2, "h"},
   {5, 2, 2, "h"},
   {5, 3, 2, "v"},
   {5, 5, 2, "v"},
   {6, 5, 2, "v"}
  };
sols = {{2, 1}};
occmat = getoccupancymatrix[gs, rinfo];
showsystem[gs, rinfo, sols]
Export["problemdef.dat",
 Prepend[rinfo, {gs[[1]], gs[[2]], Length[rinfo], sols[[1, 1]], sols[[1, 1]]}]]
```

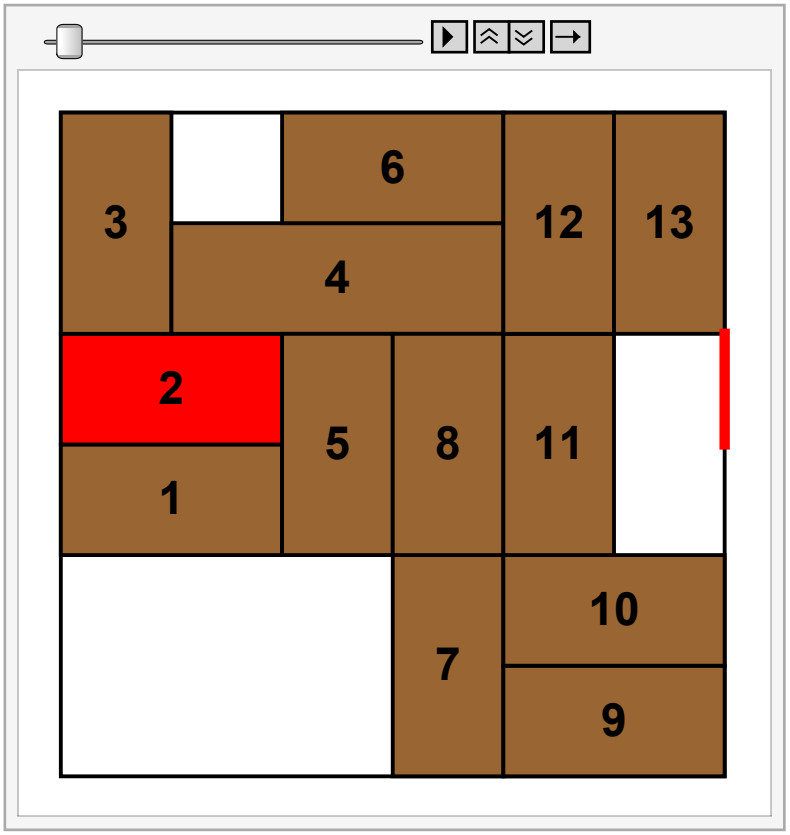
Out[48]=



Out[49]= problemdef.dat

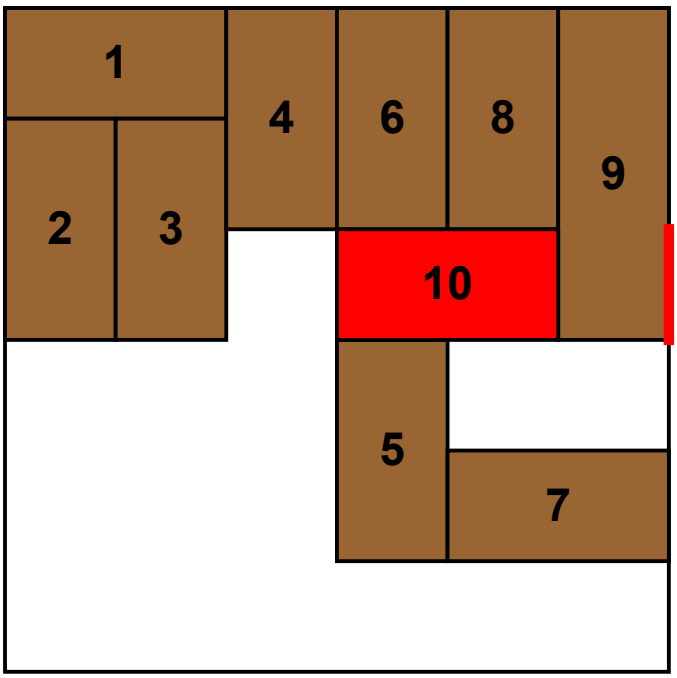
In[56]:=
```
SetDirectory["C:\\My Pug's Stuff\\OneDrive\\Main
     repository\\WorkBunny\\Random LOLs\\unblockme\\unblockme"];
dat = Import["problemsol.dat"];
solmvs = dat[[2 ;;]];
state = showsystem[gs, #, sols] & /@ ApplyMovesNested[rinfo, solmvs];
ListAnimate[state, AnimationRunning → False, AnimationRepetitions → 1]
SetDirectory[NotebookDirectory[]];
Export["unblockme_solution.gif", state, "DisplayDurations" → 0.5]
```

Out[60]=



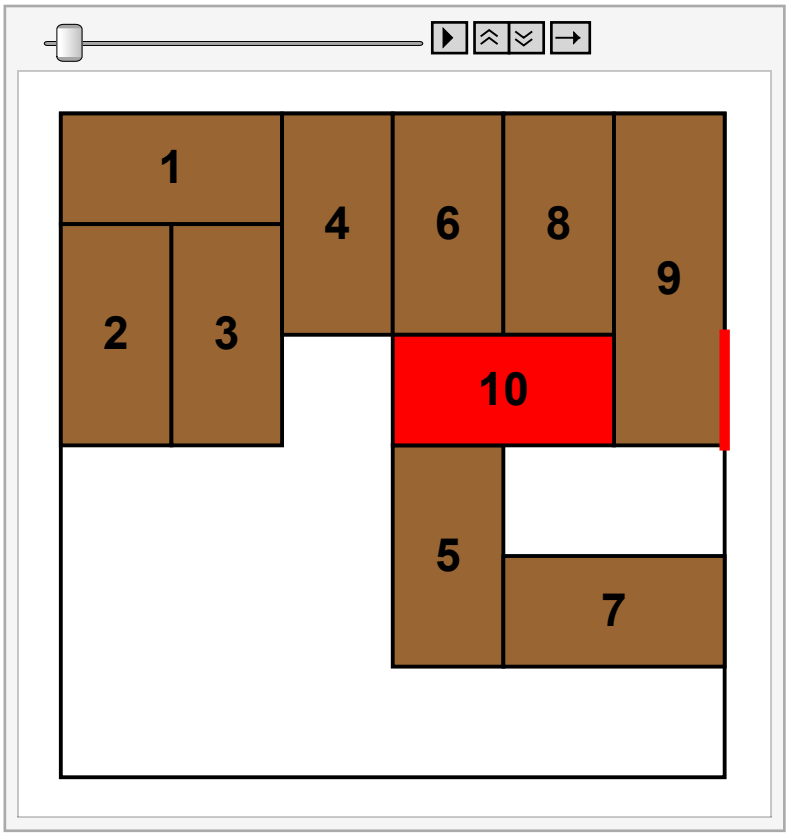

Out[62]= unblockme_solution.gif

```
gs = {6, 6};
rinfo = {
    {1, 6, 2, "h"},
    {1, 4, 2, "v"},
    {2, 4, 2, "v"},
    {3, 5, 2, "v"},
    {4, 2, 2, "v"},
    {4, 5, 2, "v"},
    {5, 2, 2, "h"},
    {5, 5, 2, "v"},
    {6, 4, 3, "v"},
    {4, 4, 2, "h"}
   };
sols = {{10, 1}};
occmat = getoccupancymatrix[gs, rinfo];
showsystem[gs, rinfo, sols]
Export["problemdef.dat",
 Prepend[rinfo, {gs[[1]], gs[[2]], Length[rinfo], sols[[1, 1]], sols[[1, 1]]}]]
(*showoccupancy[occmat]
 SolutionQ[rinfo,sols,occmat]*)
```



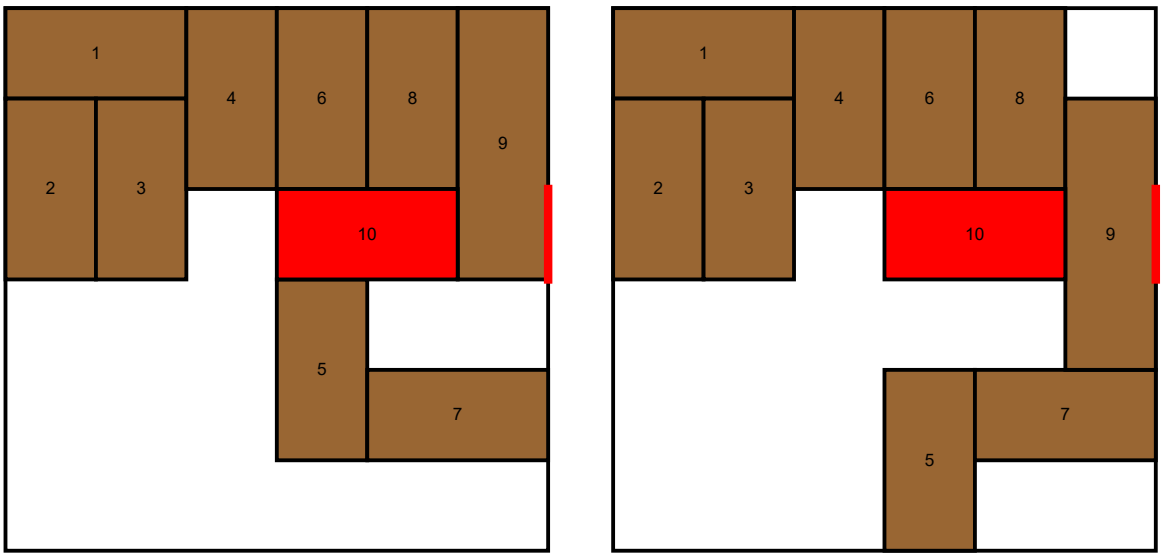

problemdef.dat

```
SetDirectory["C:\\My Pug's Stuff\\OneDrive\\Main
    repository\\WorkBunny\\Random LOLs\\unblockme\\unblockme"];
dat = Import["problemsol.dat"];
solmvs = dat[[2 ;;]];
state = showsystem[gs, #, sols] & /@ ApplyMovesNested[rinfo, solmvs];
ListAnimate[state, AnimationRunning → False, AnimationRepetitions → 1]
Export["unblockme_solution.gif", state, "DisplayDurations" → 0.5]
```

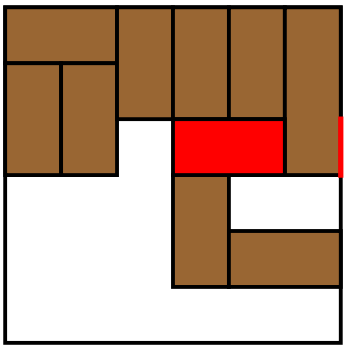



unblockme_solution.gif

```
rtest = {
    {0, 5, 2, "h"},
    {0, 3, 2, "v"},
    {1, 3, 2, "v"},
    {2, 4, 2, "v"},
    {3, 0, 2, "v"},
    {3, 4, 2, "v"},
    {4, 1, 2, "h"},
    {4, 4, 2, "v"},
    {5, 2, 3, "v"},
    {3, 3, 2, "h"}
   };
rtest2 = {
    {3, 5, 2, "h"},
    {0, 4, 2, "v"},
    {1, 4, 2, "v"},
    {2, 4, 2, "v"},
    {3, 0, 2, "v"},
    {3, 3, 2, "v"},
    {4, 1, 2, "h"},
    {4, 3, 2, "v"},
    {5, 2, 3, "v"},
    {0, 3, 2, "h"}
   };
rtest[[ ;; , {1, 2}]] += 1;
rtest2[[ ;; , {1, 2}]] += 1;
GraphicsRow[{showsystem[gs, rinfo, sols],
   showsystem[gs, rtest, sols], showsystem[gs, rtest2, sols]}]
```

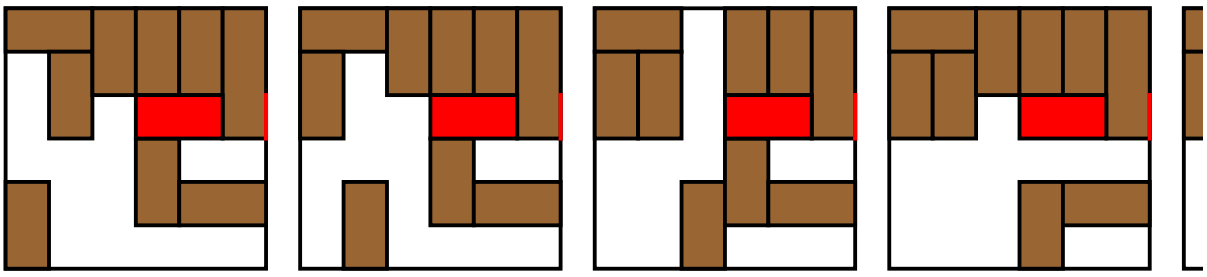


```
showsystem[gs, rinfo, sols]
FindMoves[rinfo, occmat]
ApplyMove[rinfo, #] & /@ %
GraphicsRow@(showsystem[gs, #, sols] & /@ %)
SolutionQ[#, sols, getoccupancymatrix[gs, #]] & /@ %%
```



$$\begin{pmatrix} 2 & 0 & -3 \\ 3 & 0 & -3 \\ 4 & 0 & -4 \\ 5 & 0 & -1 \\ 9 & 0 & -1 \\ 10 & -1 & 0 \end{pmatrix}$$

$$\begin{pmatrix} \{1,6,2,h\} & \{1,1,2,v\} & \{2,4,2,v\} & \{3,5,2,v\} & \{4,2,2,v\} & \{4,5,2,v\} & \{5,2,2,h\} & \{5,5,2,v\} & \{6,4,3,v\} & \{4,4 \\ \{1,6,2,h\} & \{1,4,2,v\} & \{2,1,2,v\} & \{3,5,2,v\} & \{4,2,2,v\} & \{4,5,2,v\} & \{5,2,2,h\} & \{5,5,2,v\} & \{6,4,3,v\} & \{4,4 \\ \{1,6,2,h\} & \{1,4,2,v\} & \{2,4,2,v\} & \{3,1,2,v\} & \{4,2,2,v\} & \{4,5,2,v\} & \{5,2,2,h\} & \{5,5,2,v\} & \{6,4,3,v\} & \{4,4 \\ \{1,6,2,h\} & \{1,4,2,v\} & \{2,4,2,v\} & \{3,5,2,v\} & \{4,1,2,v\} & \{4,5,2,v\} & \{5,2,2,h\} & \{5,5,2,v\} & \{6,4,3,v\} & \{4,4 \\ \{1,6,2,h\} & \{1,4,2,v\} & \{2,4,2,v\} & \{3,5,2,v\} & \{4,2,2,v\} & \{4,5,2,v\} & \{5,2,2,h\} & \{5,5,2,v\} & \{6,3,3,v\} & \{4,4 \\ \{1,6,2,h\} & \{1,4,2,v\} & \{2,4,2,v\} & \{3,5,2,v\} & \{4,2,2,v\} & \{4,5,2,v\} & \{5,2,2,h\} & \{5,5,2,v\} & \{6,4,3,v\} & \{3,4 \end{pmatrix}$$



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