Métodos iterativos para resolver ecuaciones lineales

Tamaño del dibujo

Método tradicional (tamaño dado en el dibujo)

```
mM = DiagonalMatrix[{1, 1, 1, 1, 1, 1}] -
   {{0, 1, 1, 0, 0, 0},
     {1, 0, 0, 1, 0, 0},
     {1, 0, 0, 1, 1, 0},
     {0, 1, 1, 0, 0, 1},
     {0, 0, 1, 0, 0, 1},
     {0, 0, 0, 1, 1, 0}
    } / 4
```

$$\left\{\left\{1, -\frac{1}{4}, -\frac{1}{4}, 0, 0, 0\right\}, \left\{-\frac{1}{4}, 1, 0, -\frac{1}{4}, 0, 0\right\}, \left\{-\frac{1}{4}, 0, 1, -\frac{1}{4}, -\frac{1}{4}, 0\right\}, \left\{0, -\frac{1}{4}, -\frac{1}{4}, 1, 0, -\frac{1}{4}\right\}, \left\{0, 0, -\frac{1}{4}, 0, 1, -\frac{1}{4}\right\}, \left\{0, 0, 0, -\frac{1}{4}, -\frac{1}{4}, 1\right\}\right\}$$

```
mM // MatrixForm
```

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

```
mM.{t1, t2, t3, t4, t5, t6}
```

$$\left\{t1 - \frac{t2}{4} - \frac{t3}{4}, -\frac{t1}{4} + t2 - \frac{t4}{4}, -\frac{t1}{4} + t3 - \frac{t4}{4} - \frac{t5}{4}, -\frac{t2}{4} - \frac{t3}{4} + t4 - \frac{t6}{4}, -\frac{t3}{4} + t5 - \frac{t6}{4}, -\frac{t4}{4} - \frac{t5}{4} + t6\right\}$$

```
mM.{t1, t2, t3, t4, t5, t6} // MatrixForm
```

$$\begin{pmatrix} t1 - \frac{t2}{4} - \frac{t3}{4} \\ -\frac{t1}{4} + t2 - \frac{t4}{4} \\ -\frac{t1}{4} + t3 - \frac{t4}{4} - \frac{t5}{4} \\ -\frac{t2}{4} - \frac{t3}{4} + t4 - \frac{t6}{4} \\ -\frac{t3}{4} + t5 - \frac{t6}{4} \\ -\frac{t4}{4} - \frac{t5}{4} + t6 \end{pmatrix}$$

```
Clear[izq, der, ar, ab, bb]
```

```
bb = {ar, ar, 0, 0, 0, 0} / 4 + {0, 0, 0, 0, ab, ab} / 4 +
    {izq, 0, izq, 0, izq, 0} / 4 + {0, der, 0, der, 0, der} / 4;
```

```
Solve[mM.{t1, t2, t3, t4, t5, t6} == bb, {t1, t2, t3, t4, t5, t6}]
```

$$\left\{\left\{t1 \to \frac{1}{483}\left(23\,ab + 184\,ar + 75\,der + 201\,izq\right),\right.\right.$$
$$t2 \to \frac{1}{483}\left(23\,ab + 184\,ar + 201\,der + 75\,izq\right),\ t3 \to \frac{1}{161}\left(23\,ab + 23\,ar + 33\,der + 82\,izq\right),$$
$$t4 \to \frac{1}{161}\left(23\,ab + 23\,ar + 82\,der + 33\,izq\right),\ t5 \to \frac{1}{483}\left(184\,ab + 23\,ar + 75\,der + 201\,izq\right),$$
$$\left.\left.t6 \to \frac{1}{483}\left(184\,ab + 23\,ar + 201\,der + 75\,izq\right)\right\}\right\}$$

```
LinearSolve[mM, bb]
```

$$\left\{\frac{1}{483}\left(23\,ab + 184\,ar + 75\,der + 201\,izq\right),\ \frac{1}{483}\left(23\,ab + 184\,ar + 201\,der + 75\,izq\right),\right.$$
$$\frac{1}{161}\left(23\,ab + 23\,ar + 33\,der + 82\,izq\right),\ \frac{1}{161}\left(23\,ab + 23\,ar + 82\,der + 33\,izq\right),$$
$$\left.\frac{1}{483}\left(184\,ab + 23\,ar + 75\,der + 201\,izq\right),\ \frac{1}{483}\left(184\,ab + 23\,ar + 201\,der + 75\,izq\right)\right\}$$

```
izq = 2; der = 0; ar = 0; ab = 1;
```

```
Solve[mM.{t1, t2, t3, t4, t5, t6} == bb, {t1, t2, t3, t4, t5, t6}]
```

$$\left\{\left\{t1 \to \frac{425}{483},\ t2 \to \frac{173}{483},\ t3 \to \frac{187}{161},\ t4 \to \frac{89}{161},\ t5 \to \frac{586}{483},\ t6 \to \frac{334}{483}\right\}\right\}$$

```
LinearSolve[mM, bb]
```

$$\left\{\frac{425}{483},\ \frac{173}{483},\ \frac{187}{161},\ \frac{89}{161},\ \frac{586}{483},\ \frac{334}{483}\right\}$$

```
N[%]
```

```
{0.879917, 0.358178, 1.16149, 0.552795, 1.21325, 0.691511}
```

Método iterativo (Jacobi, se puede paralelizar) (tamaño dado en el dibujo)

```
invDiag = Table[1 / mM[[c, c]], {c, 1, 6}]
```

```
{1, 1, 1, 1, 1, 1}
```

```
rR = Table[If[d == c, 0, mM[[d, c]]], {d, 1, 6}, {c, 1, 6}]
```

$$\left\{\left\{0, -\frac{1}{4}, -\frac{1}{4}, 0, 0, 0\right\}, \left\{-\frac{1}{4}, 0, 0, -\frac{1}{4}, 0, 0\right\}, \left\{-\frac{1}{4}, 0, 0, -\frac{1}{4}, -\frac{1}{4}, 0\right\},\right.$$
$$\left.\left\{0, -\frac{1}{4}, -\frac{1}{4}, 0, 0, -\frac{1}{4}\right\}, \left\{0, 0, -\frac{1}{4}, 0, 0, -\frac{1}{4}\right\}, \left\{0, 0, 0, -\frac{1}{4}, -\frac{1}{4}, 0\right\}\right\}$$

```
rR // MatrixForm
```

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

```
invMatDiag = Table[If[d == c, 1 / mM[[d, c]], 0], {d, 1, 6}, {c, 1, 6}];
```

```
invMatDiag // MatrixForm
```

$$\begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix}$$

```
xX = {0, 0, 0, 0, 0, 0};
```

```
For[contador = 1, contador < 20,
 contador++,
 (* Estas dos cosas son equivalentes, pero la segunda hace menos cuentas *)
 (* xX = invMatDiag.(bb-rR.xX); *)
 xX = invDiag * (bb - rR.xX);
 Print[N[xX]]
]
```

```
{0.5, 0., 0.5, 0., 0.75, 0.25}
{0.625, 0.125, 0.8125, 0.1875, 0.9375, 0.4375}
{0.734375, 0.203125, 0.9375, 0.34375, 1.0625, 0.53125}
{0.785156, 0.269531, 1.03516, 0.417969, 1.11719, 0.601563}
{0.826172, 0.300781, 1.08008, 0.476563, 1.15918, 0.633789}
{0.845215, 0.325684, 1.11548, 0.503662, 1.17847, 0.658936}
{0.860291, 0.337219, 1.13184, 0.525024, 1.1936, 0.670532}
{0.867264, 0.346329, 1.14473, 0.534897, 1.20059, 0.679657}
{0.872765, 0.35054, 1.15069, 0.542679, 1.2061, 0.683872}
{0.875307, 0.353861, 1.15539, 0.546275, 1.20864, 0.687194}
{0.877311, 0.355396, 1.15756, 0.54911, 1.21064, 0.688729}
{0.878238, 0.356605, 1.15927, 0.55042, 1.21157, 0.689939}
{0.878968, 0.357164, 1.16006, 0.551453, 1.2123, 0.690498}
{0.879305, 0.357605, 1.16068, 0.55193, 1.21264, 0.690938}
{0.879571, 0.357809, 1.16097, 0.552306, 1.2129, 0.691142}
{0.879694, 0.357969, 1.1612, 0.55248, 1.21303, 0.691303}
{0.879791, 0.358044, 1.1613, 0.552617, 1.21312, 0.691377}
{0.879836, 0.358102, 1.16138, 0.55268, 1.21317, 0.691435}
{0.879871, 0.358129, 1.16142, 0.55273, 1.2132, 0.691462}
```

```
Partition[{p1, p2, p3, p4, p5, p6}, 2] // MatrixForm
```

$$\begin{pmatrix} p1 & p2 \\ p3 & p4 \\ p5 & p6 \end{pmatrix}$$

Tamaño p×q nodos interiores (p horizontal, q vertical)

Método tradicional (tamaño p×q nodos interiores, p horizontal, q vertical)

```
crearM[p_, q_] :=
 Block[{matriz, j, k},
  matriz = DiagonalMatrix[Table[1, p * q]];
  For[j = 1, j <= p, j++,
   For[k = 1, k <= q, k++,
    If[j > 1, matriz[[(k - 1) * p + j, (k - 1) * p + j - 1]] = -1 / 4];
    If[j < p, matriz[[(k - 1) * p + j, (k - 1) * p + j + 1]] = -1 / 4];
    If[k > 1, matriz[[(k - 1) * p + j, (k - 2) * p + j]] = -1 / 4];
    If[k < q, matriz[[(k - 1) * p + j, k * p + j]] = -1 / 4];
   ]
  ];
  Return[matriz]
 ]
```

```
crearb[p_, q_, izq_, der_, ar_, ab_] :=
 Block[{vector, j, k},
  vector = Table[0, p * q];
  vector[[1]] = izq / 4 + ar / 4;
  vector[[p]] = der / 4 + ar / 4;
  vector[[(q - 1) * p + 1]] = izq / 4 + ab / 4;
  vector[[p * q]] = der / 4 + ab / 4;
  For[j = 2, j < p, j++,
   vector[[j]] = ar / 4;
   vector[[(q - 1) * p + j]] = ab / 4;
  ];
  For[k = 2, k < q, k++,
   vector[[(k - 1) * p + 1]] = izq / 4;
   vector[[k * p]] = der / 4;
  ];
  Return[vector]
 ]
```

```
{crearM[2, 3] // MatrixForm, crearb[2, 3, 2, 0, 0, 1] // MatrixForm}
```

$$\left\{\begin{pmatrix} 1 & -\frac{1}{4} & -\frac{1}{4} & 0 & 0 & 0 \\ -\frac{1}{4} & 1 & 0 & -\frac{1}{4} & 0 & 0 \\ -\frac{1}{4} & 0 & 1 & -\frac{1}{4} & -\frac{1}{4} & 0 \\ 0 & -\frac{1}{4} & -\frac{1}{4} & 1 & 0 & -\frac{1}{4} \\ 0 & 0 & -\frac{1}{4} & 0 & 1 & -\frac{1}{4} \\ 0 & 0 & 0 & -\frac{1}{4} & -\frac{1}{4} & 1 \end{pmatrix}, \begin{pmatrix} \frac{1}{2} \\ 0 \\ \frac{1}{2} \\ 0 \\ \frac{3}{4} \\ \frac{1}{4} \end{pmatrix}\right\}$$

```
{mM // MatrixForm, bb // MatrixForm}
```

```
{mM, bb}
```

```
{crearM[5, 4] // MatrixForm, crearb[5, 4, 2, 0, 0, 1] // MatrixForm}
```

$$\left\{\begin{pmatrix}
1 & -\frac{1}{4} & 0 & 0 & 0 & -\frac{1}{4} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{1}{4} & 1 & -\frac{1}{4} & 0 & 0 & 0 & -\frac{1}{4} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{1}{4} & 1 & -\frac{1}{4} & 0 & 0 & 0 & -\frac{1}{4} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{1}{4} & 1 & -\frac{1}{4} & 0 & 0 & 0 & -\frac{1}{4} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{1}{4} & 1 & 0 & 0 & 0 & 0 & -\frac{1}{4} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{1}{4} & 0 & 0 & 0 & 0 & 1 & -\frac{1}{4} & 0 & 0 & 0 & -\frac{1}{4} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{1}{4} & 0 & 0 & 0 & -\frac{1}{4} & 1 & -\frac{1}{4} & 0 & 0 & 0 & -\frac{1}{4} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{1}{4} & 0 & 0 & 0 & -\frac{1}{4} & 1 & -\frac{1}{4} & 0 & 0 & 0 & -\frac{1}{4} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{1}{4} & 0 & 0 & 0 & -\frac{1}{4} & 1 & -\frac{1}{4} & 0 & 0 & 0 & -\frac{1}{4} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{1}{4} & 0 & 0 & 0 & -\frac{1}{4} & 1 & 0 & 0 & 0 & 0 & -\frac{1}{4} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{1}{4} & 0 & 0 & 0 & 0 & 1 & -\frac{1}{4} & 0 & 0 & 0 & -\frac{1}{4} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{1}{4} & 0 & 0 & 0 & -\frac{1}{4} & 1 & -\frac{1}{4} & 0 & 0 & 0 & -\frac{1}{4} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{1}{4} & 0 & 0 & 0 & -\frac{1}{4} & 1 & -\frac{1}{4} & 0 & 0 & 0 & -\frac{1}{4} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{1}{4} & 0 & 0 & 0 & -\frac{1}{4} & 1 & -\frac{1}{4} & 0 & 0 & 0 & -\frac{1}{4} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{1}{4} & 0 & 0 & 0 & -\frac{1}{4} & 1 & 0 & 0 & 0 & 0 & -\frac{1}{4} \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{1}{4} & 0 & 0 & 0 & 0 & 1 & -\frac{1}{4} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{1}{4} & 0 & 0 & 0 & -\frac{1}{4} & 1 & -\frac{1}{4} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{1}{4} & 0 & 0 & 0 & -\frac{1}{4} & 1 & -\frac{1}{4} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{1}{4} & 0 & 0 & 0 & -\frac{1}{4} & 1 & -\frac{1}{4} \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{1}{4} & 0 & 0 & 0 & -\frac{1}{4} & 1
\end{pmatrix},\right.$$

$$\left.\begin{pmatrix}
\frac{1}{2} \\ 0 \\ 0 \\ 0 \\ 0 \\ \frac{1}{2} \\ 0 \\ 0 \\ 0 \\ 0 \\ \frac{1}{2} \\ 0 \\ 0 \\ 0 \\ 0 \\ \frac{3}{4} \\ \frac{1}{4} \\ \frac{1}{4} \\ \frac{1}{4} \\ \frac{1}{4}
\end{pmatrix}\right\}$$

```
LinearSolve[crearM[5, 4], crearb[5, 4, 2, 0, 0, 1]]
```

$$\left\{\frac{1\,702\,027}{1\,762\,915}, \frac{87\,127}{160\,265}, \frac{118\,365}{352\,583}, \frac{33\,143}{160\,265}, \frac{180\,353}{1\,762\,915}, \frac{331\,983}{251\,845}, \frac{139\,976}{160\,265}, \frac{29\,838}{50\,369}, \frac{62\,374}{160\,265}, \frac{2683}{13\,255}, \frac{19\,007}{13\,255}, \frac{166\,576}{160\,265}, \frac{38\,847}{50\,369}, \frac{88\,974}{160\,265}, \frac{80\,127}{251\,845}, \frac{2\,429\,677}{1\,762\,915}, \frac{172\,912}{160\,265}, \frac{316\,640}{352\,583}, \frac{118\,928}{160\,265}, \frac{908\,003}{1\,762\,915}\right\}$$

```
N[%]
```

```
{0.965462, 0.543643, 0.335708, 0.206801, 0.102304, 1.3182,
 0.873403, 0.592388, 0.389193, 0.202414, 1.43395, 1.03938, 0.771248,
 0.555168, 0.31816, 1.37822, 1.07891, 0.898058, 0.742071, 0.515058}
```

Método iterativo (Jacobi, se puede paralelizar)
(tamaño p×q nodos interiores, p horizontal, q vertical)

```
(* Realmente no se necesita,
pues basta con quedarse con la diagonal sin hacerla matriz *)
crearInvMatrDiag[p_, q_, matrizM_] :=
 Block[{c, d},
  Table[If[d == c, 1 / matrizM[[d, c]], 0], {d, 1, p * q}, {c, 1, p * q}]
 ]
```

```
crearInvMatrDiag[2, 3, crearM[2, 3]] // MatrixForm
```

$$\begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix}$$

```
crearR[p_, q_, matrizM_] :=
 Block[{matrizR, c, d},
  matrizR = Table[If[d == c, 0, matrizM[[d, c]]], {d, 1, p * q}, {c, 1, p * q}];
  Return[matrizR]
 ]
```

```
crearR[2, 3, crearM[2, 3]] // MatrixForm
```

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

```
crearR[5, 4, crearM[5, 4]] // MatrixForm
```

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

```
Clear[iteracionesJacobi]

iteracionesJacobi[p_, q_, izq_, der_, ar_, ab_, numero_] :=
 Block[{xX, invDiag, matrizM, vectorb, matrizR, contador},
  xX = Table[0, p * q];
  matrizM = crearM[p, q];
  vectorb = crearb[p, q, izq, der, ar, ab];
  invDiag = Table[1 / matrizM[[c, c]], {c, 1, p * q}];
  matrizR = crearR[p, q, matrizM];
  For[contador = 1, contador < numero,
   contador++,
   (* Estas dos cosas son equivalentes, pero la segunda hace menos cuentas *)
   (* xX = N[invMatDiag.(bb-matrizR.xX)]; *)
   xX = N[invDiag * (vectorb - matrizR.xX)];
   Print[xX]
  ];
  Return[xX]
 ]

iteracionesJacobi[2, 3, 2, 0, 0, 1, 20]
```

```
{0.5, 0., 0.5, 0., 0.75, 0.25}
{0.625, 0.125, 0.8125, 0.1875, 0.9375, 0.4375}
{0.734375, 0.203125, 0.9375, 0.34375, 1.0625, 0.53125}
{0.785156, 0.269531, 1.03516, 0.417969, 1.11719, 0.601563}
{0.826172, 0.300781, 1.08008, 0.476563, 1.15918, 0.633789}
{0.845215, 0.325684, 1.11548, 0.503662, 1.17847, 0.658936}
{0.860291, 0.337219, 1.13184, 0.525024, 1.1936, 0.670532}
{0.867264, 0.346329, 1.14473, 0.534897, 1.20059, 0.679657}
{0.872765, 0.35054, 1.15069, 0.542679, 1.2061, 0.683872}
{0.875307, 0.353861, 1.15539, 0.546275, 1.20864, 0.687194}
{0.877311, 0.355396, 1.15756, 0.54911, 1.21064, 0.688729}
{0.878238, 0.356605, 1.15927, 0.55042, 1.21157, 0.689939}
{0.878968, 0.357164, 1.16006, 0.551453, 1.2123, 0.690498}
{0.879305, 0.357605, 1.16068, 0.55193, 1.21264, 0.690938}
{0.879571, 0.357809, 1.16097, 0.552306, 1.2129, 0.691142}
{0.879694, 0.357969, 1.1612, 0.55248, 1.21303, 0.691303}
{0.879791, 0.358044, 1.1613, 0.552617, 1.21312, 0.691377}
{0.879836, 0.358102, 1.16138, 0.55268, 1.21317, 0.691435}
{0.879871, 0.358129, 1.16142, 0.55273, 1.2132, 0.691462}
{0.879871, 0.358129, 1.16142, 0.55273, 1.2132, 0.691462}
```

```
solucion = iteracionesJacobi[5, 4, 2, 0, 0, 1, 20]
```

{0.5, 0., 0., 0., 0., 0.5, 0., 0., 0., 0., 0.5, 0., 0., 0., 0., 0.75, 0.25, 0.25, 0.25, 0.25}

{0.625, 0.125, 0., 0., 0., 0.75, 0.125, 0., 0., 0., 0.8125,
 0.1875, 0.0625, 0.0625, 0.0625, 0.9375, 0.5, 0.375, 0.375, 0.3125}

{0.71875, 0.1875, 0.03125, 0., 0., 0.890625, 0.265625, 0.046875, 0.015625, 0.015625,
 0.96875, 0.375, 0.15625, 0.125, 0.09375, 1.07813, 0.625, 0.484375, 0.4375, 0.359375}

{0.769531, 0.253906, 0.0585938, 0.0117188, 0.00390625, 0.988281,
 0.375, 0.117188, 0.046875, 0.0273438, 1.08594, 0.503906, 0.257813,
 0.175781, 0.125, 1.14844, 0.734375, 0.554688, 0.492188, 0.382813}

{0.810547, 0.300781, 0.0957031, 0.0273438, 0.00976563, 1.05762,
 0.46582, 0.18457, 0.0830078, 0.0439453, 1.16016, 0.613281, 0.337891,
 0.230469, 0.146484, 1.20508, 0.801758, 0.621094, 0.52832, 0.404297}

{0.8396, 0.343018, 0.128174, 0.0471191, 0.0178223, 1.10913,
 0.539063, 0.245605, 0.121582, 0.0598145, 1.21899, 0.691406, 0.412354,
 0.273926, 0.169678, 1.24048, 0.859863, 0.666992, 0.563965, 0.418701}

{0.863037, 0.376709, 0.158936, 0.0668945, 0.0267334, 1.14941,
 0.59729, 0.300293, 0.156616, 0.0772705, 1.26025, 0.757568, 0.469482,
 0.316895, 0.18811, 1.26971, 0.899719, 0.709045, 0.589905, 0.433411}

{0.881531, 0.404816, 0.185974, 0.0855713, 0.0360413, 1.18015,
 0.645996, 0.345581, 0.190338, 0.092865, 1.29417, 0.806686, 0.52095,
 0.351028, 0.206894, 1.28999, 0.934082, 0.739777, 0.614838, 0.444504}

{0.89624, 0.428375, 0.208992, 0.103088, 0.0446091, 1.20543,
 0.684307, 0.385815, 0.218761, 0.108318, 1.31921, 0.848801, 0.560768,
 0.383255, 0.222099, 1.30706, 0.959114, 0.767467, 0.633827, 0.455433}

{0.90845, 0.447385, 0.22932, 0.118091, 0.0528517, 1.22494,
 0.717104, 0.418207, 0.245119, 0.121367, 1.34032, 0.880849, 0.596334,
 0.408864, 0.236752, 1.31958, 0.980833, 0.788427, 0.651539, 0.463982}

{0.918081, 0.463718, 0.245921, 0.131823, 0.0598645, 1.24147,
 0.742845, 0.446969, 0.266632, 0.133681, 1.35634, 0.908648, 0.624087,
 0.432436, 0.248553, 1.33029, 0.997214, 0.807177, 0.665318, 0.472073}

{0.926297, 0.476712, 0.260628, 0.143104, 0.0663758, 1.25432,
 0.765201, 0.469871, 0.286227, 0.143763, 1.3701, 0.930122, 0.648808,
 0.451148, 0.259547, 1.33839, 1.01153, 0.821655, 0.677921, 0.478468}

{0.932757, 0.488031, 0.272422, 0.153308, 0.0717167, 1.2654,
 0.782755, 0.490216, 0.301971, 0.153038, 1.38071, 0.94891, 0.668199,
 0.468126, 0.268345, 1.34541, 1.02254, 0.834564, 0.687818, 0.484367}

{0.938358, 0.496984, 0.282889, 0.161527, 0.0765863, 1.27405,
 0.798139, 0.506337, 0.316172, 0.160508, 1.38993, 0.963551, 0.685454,
 0.481583, 0.276383, 1.35081, 1.03222, 0.844639, 0.696764, 0.489041}

{0.94276, 0.504846, 0.291212, 0.168912, 0.0805089, 1.28161,
 0.810231, 0.520663, 0.327489, 0.167285, 1.3971, 0.976436, 0.699028,
 0.493693, 0.282783, 1.35554, 1.03975, 0.85361, 0.703816, 0.493287}

{0.946613, 0.511051, 0.298605, 0.174802, 0.0840492, 1.28752,
 0.820888, 0.53199, 0.337638, 0.172695, 1.40339, 0.986528, 0.7111,
 0.503279, 0.288566, 1.35921, 1.0464, 0.860648, 0.710147, 0.49665}

{0.949644, 0.516527, 0.304461, 0.180073, 0.0868744, 1.29272,
 0.829273, 0.542058, 0.345692, 0.177563, 1.40832, 0.995445, 0.720611,
 0.511863, 0.293156, 1.36245, 1.0516, 0.866911, 0.715144, 0.499678}

{0.952313, 0.520844, 0.309664, 0.184257, 0.0894092, 1.29681,
 0.836688, 0.550009, 0.352889, 0.18143, 1.41265, 1.00245, 0.729069,
 0.518651, 0.297276, 1.36498, 1.0562, 0.871838, 0.719613, 0.502075}

{0.954413, 0.524666, 0.313778, 0.187991, 0.0914218, 1.30041,
 0.842528, 0.557078, 0.358587, 0.184894, 1.41606, 1.00865, 0.735737,
 0.524712, 0.300539, 1.36721, 1.05982, 0.876221, 0.723141, 0.504222}

```
{0.954413, 0.524666, 0.313778, 0.187991, 0.0914218, 1.30041,
 0.842528, 0.557078, 0.358587, 0.184894, 1.41606, 1.00865, 0.735737,
 0.524712, 0.300539, 1.36721, 1.05982, 0.876221, 0.723141, 0.504222}
```

```
temperaturaInterior = Partition[solucion, 5]
```

```
{{0.954413, 0.524666, 0.313778, 0.187991, 0.0914218},
 {1.30041, 0.842528, 0.557078, 0.358587, 0.184894},
 {1.41606, 1.00865, 0.735737, 0.524712, 0.300539},
 {1.36721, 1.05982, 0.876221, 0.723141, 0.504222}}
```

https://reference.wolfram.com/language/guide/ColorSchemes.html

```
(* NOTA: En el dibujo, "arriba" está abajo *)
ListDensityPlot[temperaturaInterior,
 Mesh → None, ColorFunction → "ThermometerColors"]
```