**diag() — Create diagonal matrix**

### Syntax

- `numeric matrix diag(numeric matrix Z)`
- `numeric matrix diag(numeric vector z)`

### Description

`diag()` creates diagonal matrices.

- `diag(Z)`, $Z$ a matrix, extracts the principal diagonal of $Z$ to create a new matrix. $Z$ must be square.
- `diag(z)`, $z$ a vector, creates a new matrix with the elements of $z$ on its diagonal.

### Remarks and examples

Do not confuse `diag()` with its functional inverse, `diagonal();` see [M-5] `diagonal()`. `diag()` creates a matrix from a vector (or matrix); `diagonal()` extracts the diagonal of a matrix into a vector.

Use of `diag()` should be avoided because it wastes memory. The **colon operators** will allow you to use vectors directly:

<table>
<thead>
<tr>
<th>Desired calculation</th>
<th>Equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>diag(v)*X</code>,</td>
<td></td>
</tr>
<tr>
<td>$v$ is a column</td>
<td>$v'*X$</td>
</tr>
<tr>
<td>$v$ is a row</td>
<td>$v'*:X$</td>
</tr>
<tr>
<td>$v$ is a matrix</td>
<td><code>diagonal(v):*X</code></td>
</tr>
<tr>
<td><code>X*diag(v)</code></td>
<td></td>
</tr>
<tr>
<td>$v$ is a column</td>
<td>$X:*v'$</td>
</tr>
<tr>
<td>$v$ is a row</td>
<td>$X:*v$</td>
</tr>
<tr>
<td>$v$ is a matrix</td>
<td>$X:*diagonal(v)'$</td>
</tr>
</tbody>
</table>

In the above table, it is assumed that $v$ is real. If $v$ might be complex, the transpose operators that appear must be changed to `transposeonly()` calls, because we do not want the conjugate. For instance, `$v'*:X$ would become `transposeonly(v):*X`.  

1
Conformability

\text{diag}(Z):
\begin{align*}
Z: & \quad m \times n \\
\text{result}: & \quad \min(m,n) \times \min(m,n)
\end{align*}

\text{diag}(z):
\begin{align*}
z: & \quad 1 \times n \quad \text{or} \quad n \times 1 \\
\text{result}: & \quad n \times n
\end{align*}

Diagnostics

None.

Also see

[M-5] \texttt{__diag()} — Replace diagonal of a matrix
[M-5] \texttt{diagonal()} — Extract diagonal into column vector
[M-5] \texttt{isdiagonal()} — Whether matrix is diagonal
[M-4] \texttt{manipulation} — Matrix manipulation