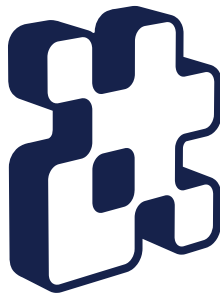


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## **LAGraph table test**



**GRAPHBLAS**

## Test site

### Table

operation/method	description	notation
<code>mxm</code>	matrix-matrix multiplication	$\mathbf{C}\langle\mathbf{M}\rangle \odot = \mathbf{A} \oplus.\otimes \mathbf{B}$
<code>vxm</code>	vector-matrix multiplication	$\mathbf{w}^T\langle\mathbf{m}^T\rangle \odot = \mathbf{u}^T \oplus.\otimes \mathbf{A}$
<code>mxv</code>	matrix-vector multiplication	$\mathbf{w}\langle\mathbf{m}\rangle \odot = \mathbf{A} \oplus.\otimes \mathbf{u}$
<code>eWiseAdd</code>	element-wise addition using operator $\text{op}$	$\mathbf{C}\langle\mathbf{M}\rangle \odot = \mathbf{A} \cup[\text{op}] \mathbf{B}$
	on elements in the set union of structures of $\mathbf{A}/\mathbf{B}$ and $\mathbf{u}/\mathbf{v}$	$\mathbf{w}\langle\mathbf{m}\rangle \odot = \mathbf{u} \cup[\text{op}] \mathbf{v}$
<code>eWiseMult</code>	element-wise multiplication using operator $\text{op}$	$\mathbf{C}\langle\mathbf{M}\rangle \odot = \mathbf{A} \cap[\text{op}] \mathbf{B}$
	on elements in the set intersection of structures of $\mathbf{A}/\mathbf{B}$ and $\mathbf{u}/\mathbf{v}$	$\mathbf{w}\langle\mathbf{m}\rangle \odot = \mathbf{u} \cap[\text{op}] \mathbf{v}$
<code>extract</code>	extract submatrix from matrix $\mathbf{A}$ using indices $\mathbf{i}$ and indices $\mathbf{j}$	$\mathbf{C}\langle\mathbf{M}\rangle \odot = \mathbf{A}(\mathbf{i},\mathbf{j})$
	extract the $i$ th row vector from matrix $\mathbf{A}$	$\mathbf{w}\langle\mathbf{m}\rangle \odot = \mathbf{A}(i,:)$
	extract the $j$ th column vector from matrix $\mathbf{A}$	$\mathbf{w}\langle\mathbf{m}\rangle \odot = \mathbf{A}(:,j)$
	extract subvector from $\mathbf{u}$ using indices $\mathbf{i}$	$\mathbf{w}\langle\mathbf{m}\rangle \odot = \mathbf{u}(\mathbf{i})$
<code>assign</code>	assign matrix to submatrix with mask for $\mathbf{C}$	$\mathbf{C}\langle\mathbf{M}\rangle(\mathbf{i},\mathbf{j}) \odot = \mathbf{A}$
	assign scalar to submatrix with mask for $\mathbf{C}$	$\mathbf{C}\langle\mathbf{M}\rangle(\mathbf{i},\mathbf{j}) \odot = s$
	assign vector to subvector with mask for $\mathbf{w}$	$\mathbf{w}\langle\mathbf{m}\rangle(\mathbf{i}) \odot = \mathbf{u}$
	assign scalar to subvector with mask for $\mathbf{w}$	$\mathbf{w}\langle\mathbf{m}\rangle(\mathbf{i}) \odot = s$

operation/method	description	notation
<code>apply</code>	apply unary operator $f$ with optional thunk $k$	$\mathbf{C}\langle \mathbf{M} \rangle \odot = f(\mathbf{A}, k)$ $\mathbf{w}\langle \mathbf{m} \rangle \odot = f(\mathbf{u}, k)$
<code>select</code>	apply select operator $f$ with optional thunk $k$	$\mathbf{C}\langle \mathbf{M} \rangle \odot = \mathbf{A}\langle f(\mathbf{A}, k) \rangle$ $\mathbf{w}\langle \mathbf{m} \rangle \odot = \mathbf{u}\langle f(\mathbf{u}, k) \rangle$
<code>reduce</code>	row-wise reduce matrix to column vector	$\mathbf{w}\langle \mathbf{m} \rangle \odot = [\oplus_j \mathbf{A}(:, j)]$
	reduce matrix to scalar	$s \odot = [\oplus_{i,j} \mathbf{A}(i, j)]$
	reduce vector to scalar	$s \odot = [\oplus_i \mathbf{u}(i)]$
<code>transpose</code>	transpose	$\mathbf{C}\langle \mathbf{M} \rangle \odot = \mathbf{A}^\top$
<code>kron</code>	Kronecker multiplication using operator $\text{op}$	$\mathbf{C}\langle \mathbf{M} \rangle \odot = \text{kron}(\mathbf{A}, \text{op}, \mathbf{B})$

GraphBLAS operations and methods. Notation: Matrices and vectors are typeset in bold, starting with uppercase ( $\mathbf{A}$ ) and lowercase ( $\mathbf{u}$ ) letters, respectively. Scalars including indices are lowercase italic ( $k, i, j$ ) while arrays are lowercase bold italic ( $\mathbf{x}, \mathbf{i}, \mathbf{j}$ ).  $\oplus$  and  $\otimes$  are the addition and multiplication operators forming a semiring and default to conventional arithmetic  $+$  and  $\times$  operators.  $\odot$  is the accumulator operator. Operations can be modified via a descriptor; matrices can be transposed ( $\mathbf{B}^\top$ ), the mask can be complemented ( $\mathbf{C}\langle \neg \mathbf{M} \rangle$ ), and the mask can be valued (shown above) or structural ( $\mathbf{C}\langle s(\mathbf{M}) \rangle$ ). A structural mask can also be complemented ( $\mathbf{C}\langle \neg s(\mathbf{M}) \rangle$ ). The result can be cleared (replaced) after using it as input to the mask/accumulator step ( $\mathbf{C}\langle \mathbf{M}, \mathbf{r} \rangle$ ). Not all methods are listed (creating new operators, monoids, and semirings, clearing a matrix/vector, etc.).