

# **Definition** (Semantics of UMCDPs)

Given an UMCDP  $\langle \mathcal{A}, \mathbf{T}, \mathbf{v} \rangle$ , the semantics function  $\Phi$  computes a UDP

$$\Phi[\langle \mathcal{A}, \mathbf{T}, \mathbf{v} \rangle] \in \mathbf{UDP},$$

and it is recursively defined as follows:

$$\Phi[\langle \mathcal{A}, a, \mathbf{v} \rangle] = \mathbf{v}(a), \quad \text{for all } a \in \mathcal{A}.$$

$$\mathbf{L}\Phi[\langle \mathcal{A}, \text{series}(\mathbf{T}_1, \mathbf{T}_2), \mathbf{v} \rangle] = (\mathbf{L}\Phi[\langle \mathcal{A}, \mathbf{T}_1, \mathbf{v} \rangle]) \odot (\mathbf{L}\Phi[\langle \mathcal{A}, \mathbf{T}_2, \mathbf{v} \rangle]),$$

$$\mathbf{U}\Phi[\langle \mathcal{A}, \text{series}(\mathbf{T}_1, \mathbf{T}_2), \mathbf{v} \rangle] = (\mathbf{U}\Phi[\langle \mathcal{A}, \mathbf{T}_1, \mathbf{v} \rangle]) \odot (\mathbf{U}\Phi[\langle \mathcal{A}, \mathbf{T}_2, \mathbf{v} \rangle]),$$

$$\mathbf{L}\Phi[\langle \mathcal{A}, \text{par}(\mathbf{T}_1, \mathbf{T}_2), \mathbf{v} \rangle] = (\mathbf{L}\Phi[\langle \mathcal{A}, \mathbf{T}_1, \mathbf{v} \rangle]) \otimes (\mathbf{L}\Phi[\langle \mathcal{A}, \mathbf{T}_2, \mathbf{v} \rangle]),$$

$$\mathbf{U}\Phi[\langle \mathcal{A}, \text{par}(\mathbf{T}_1, \mathbf{T}_2), \mathbf{v} \rangle] = (\mathbf{U}\Phi[\langle \mathcal{A}, \mathbf{T}_1, \mathbf{v} \rangle]) \otimes (\mathbf{U}\Phi[\langle \mathcal{A}, \mathbf{T}_2, \mathbf{v} \rangle]),$$

$$\mathbf{L}\Phi[\langle \mathcal{A}, \text{loop}(\mathbf{T}), \mathbf{v} \rangle] = (\mathbf{L}\Phi[\langle \mathcal{A}, \mathbf{T}, \mathbf{v} \rangle])^\dagger,$$

$$\mathbf{U}\Phi[\langle \mathcal{A}, \text{loop}(\mathbf{T}), \mathbf{v} \rangle] = (\mathbf{U}\Phi[\langle \mathcal{A}, \mathbf{T}, \mathbf{v} \rangle])^\dagger.$$