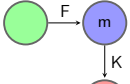
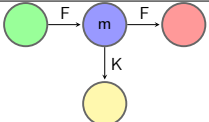
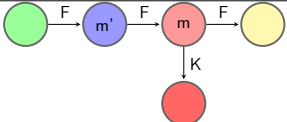
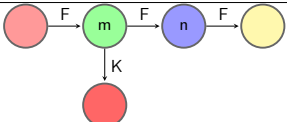
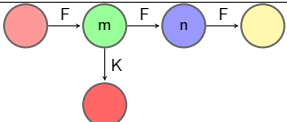
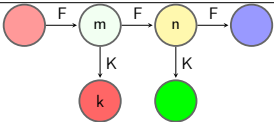
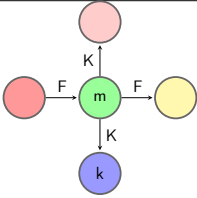
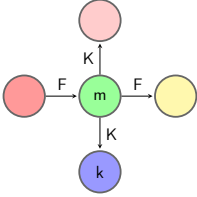


Graph Pattern	Hop Type	Expressions in $\mu - RA$
	One Hop And Branch	$\tilde{\pi}_m \left(\rho_{f_{id}}^m (F) \bowtie \rho_{p_{id}}^m (K) \right)$
	Two hops and a branch	$\tilde{\pi}_m \left(\rho_{f_{id}}^m (F) \bowtie \rho_{p_{id}}^m (F) \bowtie \rho_{p_{id}}^m (K) \right)$
	Three Hops And Branch	$\tilde{\pi}_m \left(\rho_{f_{id}}^m \left(\tilde{\pi}_m (\rho_{f_{id}}^m (F) \bowtie \rho_{p_{id}}^m (F)) \right) \bowtie \rho_{p_{id}}^m (F) \bowtie \rho_{p_{id}}^m (K) \right)$
	Three Hops And Branch	$\tilde{\pi}_{m,n} \left(\rho_{f_{id}}^n \left(\rho_{f_{id}}^m (F) \bowtie \rho_{p_{id}}^m (F) \right) \bowtie \rho_{f_{id}}^n (F) \bowtie \rho_{p_{id}}^m (K) \right)$
	Three Hops And Branch	$\tilde{\pi}_{m,n} \left(\rho_{f_{id}}^m (F) \bowtie \rho_{p_{id},f_{id}}^{m,n} (F) \bowtie \rho_{p_{id}}^n (F) \bowtie \rho_{p_{id}}^m (K) \right)$

Graph Pattern	Hop Type	Expressions in $\mu - RA$
	Three Hops And Two Branches	$\tilde{\pi}_{m,n} \left(\rho_{f_{id}}^m(F) \bowtie \rho_{p_{id}}^m \left(\rho_{f_{id}}^n(F) \right) \bowtie \rho_{p_{id}}^m \left(\rho_{k_{id}}^k(K) \right) \bowtie \rho_{p_{id}}^n(F) \bowtie \rho_{p_{id}}^n(K) \right)$
	Star (Isomorphism based semantics)	$\tilde{\pi}_m \left(\sigma_{k < k_{id}} \left(\rho_{f_{id}}^m(F) \bowtie \rho_{p_{id}}^m(F) \bowtie \rho_{p_{id}}^m(K) \bowtie \rho_{p_{id}}^m \left(\rho_{k_{id}}^k(K) \right) \right) \right)$
	Star (Homomorphism based semantics)	$\tilde{\pi}_m \left(\rho_{f_{id}}^m(F) \bowtie \rho_{p_{id}}^m(F) \bowtie \rho_{p_{id}}^m(K) \bowtie \rho_{p_{id}}^m \left(\rho_{k_{id}}^k(K) \right) \right)$