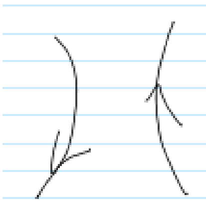
Pensieve Header: The mutation property in Gassner calculus.

```
dir = SetDirectory["C:/drorbn/AcademicPensieve/2014-06/"];
<< "MetaCalculi/MetaCalculi-Program.m"
```

Splicing Mutations



```
Clear[α, β, γ, δ, ω];
```

$$\gamma 0 = \Gamma\left[\omega,\ h_a\,\sigma_a + h_b\,\sigma_b,\ \{t_a, t_b\}.\begin{pmatrix}1-\gamma & \beta\\ \gamma & 1-\beta\end{pmatrix}.\{h_a, h_b\}\right]$$

$$\begin{pmatrix} \omega & s_a & s_b \\ s_a & 1-\gamma & \beta \\ s_b & \gamma & 1-\beta \\ \Sigma & \sigma_a & \sigma_b \end{pmatrix}$$

```
U = Xp[ap, 1] Xm[bp, 2] // Γ // dm[1, 2, 1]
```

$$\begin{pmatrix} 1 & s_1 & s_{ap} & s_{bp} \\ s_1 & \frac{T_{ap}}{T_{bp}} & 0 & 0 \\ s_{ap} & 1-T_{ap} & 1 & 0 \\ s_{bp} & \frac{T_{ap}\,(-1+T_{bp})}{T_{bp}} & 0 & 1 \\ \Sigma & \frac{T_{ap}}{T_{bp}} & 1 & 1 \end{pmatrix}$$

```
{t1 = γ0 * U // dm[a, ap, a] // dm[bp, b, b],
 t2 = γ0 * U // dm[ap, a, a] // dm[b, bp, b], t1 == t2}
```

$$\left\{\begin{pmatrix} \omega & s_1 & s_a & s_b \\ s_1 & \frac{T_a}{T_b} & 0 & 0 \\ s_a & \frac{-\beta\,T_a+T_b-T_a\,T_b+\beta\,T_a\,T_b}{T_b} & 1-\gamma & \beta \\ s_b & -\frac{(-1+\beta)\,T_a\,(-1+T_b)}{T_b} & \gamma & 1-\beta \\ \Sigma & \frac{T_a}{T_b} & \sigma_a & \sigma_b \end{pmatrix}, \begin{pmatrix} \omega & s_1 & s_a & s_b \\ s_1 & \frac{T_a}{T_b} & 0 & 0 \\ s_a & (-1+\gamma)\,(-1+T_a) & 1-\gamma & \beta \\ s_b & -\frac{T_a-\gamma\,T_b-T_a\,T_b+\gamma\,T_a\,T_b}{T_b} & \gamma & 1-\beta \\ \Sigma & \frac{T_a}{T_b} & \sigma_a & \sigma_b \end{pmatrix},\right.$$

$$\frac{-\beta\,T_a+T_b-T_a\,T_b+\beta\,T_a\,T_b}{T_b} == (-1+\gamma)\,(-1+T_a)\ \&\&$$
$$\left. -\frac{(-1+\beta)\,T_a\,(-1+T_b)}{T_b} == -\frac{T_a-\gamma\,T_b-T_a\,T_b+\gamma\,T_a\,T_b}{T_b}\right\}$$

```
Simplify[t1 == t2 /. T_ :> 8]
```

$\beta == \gamma$

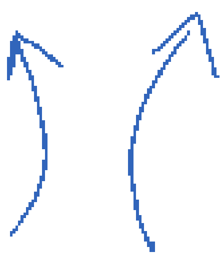
```
γ1 = Xp[1, 2] ** Xp[2, 1] // Γ // dS[2]
```

$$\left(\begin{array}{ccc} \frac{-1+T_1+T_2}{T_1 T_2} & s_1 & s_2 \\ s_1 & \frac{T_1}{-1+T_1+T_2} & \frac{-1+T_1}{-1+T_1+T_2} \\ s_2 & \frac{-1+T_2}{-1+T_1+T_2} & \frac{T_2}{-1+T_1+T_2} \\ \Sigma & \frac{1}{T_2} & \frac{1}{T_1} \end{array}\right)$$

```
{t3 = γ1 /. T_ :> T, t4 = t3 // dσ[2, 1], t3 == t4}
```

$$\left\{\left(\begin{array}{ccc} \frac{-1+2T}{T^2} & s_1 & s_2 \\ s_1 & \frac{T}{-1+2T} & \frac{-1+T}{-1+2T} \\ s_2 & \frac{-1+T}{-1+2T} & \frac{T}{-1+2T} \\ \Sigma & \frac{1}{T} & \frac{1}{T} \end{array}\right), \left(\begin{array}{ccc} \frac{-1+2T}{T^2} & s_1 & s_2 \\ s_1 & \frac{T}{-1+2T} & \frac{-1+T}{-1+2T} \\ s_2 & \frac{-1+T}{-1+2T} & \frac{T}{-1+2T} \\ \Sigma & \frac{1}{T} & \frac{1}{T} \end{array}\right), \text{True}\right\}$$

Non-Splicing Mutations



```
Clear[α, β, γ, δ, ω];
```

$$\gamma0 = \Gamma\left[\omega,\ h_a\,\sigma_a + h_b\,\sigma_b,\ \{t_a, t_b\}.\begin{pmatrix} 1-\gamma[T_a, T_b] & \beta[T_a, T_b] \\ \gamma[T_a, T_b] & 1-\beta[T_a, T_b] \end{pmatrix}.\{h_a, h_b\}\right]$$

$$\left(\begin{array}{ccc} \omega & s_a & s_b \\ s_a & 1-\gamma[T_a, T_b] & \beta[T_a, T_b] \\ s_b & \gamma[T_a, T_b] & 1-\beta[T_a, T_b] \\ \Sigma & \sigma_a & \sigma_b \end{array}\right)$$

```
Ω[n_] := Ω[n] = Table[Which[i < j, 0, i == j, 1, i > j, 1 - T], {i, n}, {j, n}];
Ω[2] // MatrixForm
```

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

```
A0 = γ0[A];
Transpose[A0].Ω[2].(A0 /. T_b → 1 / T_b)
```

$$\left\{\left\{\gamma\left[T_a, \frac{1}{T_b}\right]\gamma[T_a, T_b] + \left(1-\gamma\left[T_a, \frac{1}{T_b}\right]\right)(1-\gamma[T_a, T_b] + (1-T)\,\gamma[T_a, T_b]),\right.\right.$$
$$\left.\left(1-\beta\left[T_a, \frac{1}{T_b}\right]\right)\gamma[T_a, T_b] + \beta\left[T_a, \frac{1}{T_b}\right](1-\gamma[T_a, T_b] + (1-T)\,\gamma[T_a, T_b])\right\},$$
$$\left\{((1-T)(1-\beta[T_a, T_b]) + \beta[T_a, T_b])\left(1-\gamma\left[T_a, \frac{1}{T_b}\right]\right) + (1-\beta[T_a, T_b])\,\gamma\left[T_a, \frac{1}{T_b}\right],\right.$$
$$\left.\left.\left(1-\beta\left[T_a, \frac{1}{T_b}\right]\right)(1-\beta[T_a, T_b]) + \beta\left[T_a, \frac{1}{T_b}\right]((1-T)(1-\beta[T_a, T_b]) + \beta[T_a, T_b])\right\}\right\}$$