Pensieve header: AutoAd for OneCo. Continues pensieve://2016-03/SnG.nb.

```
SetDirectory["C:\\drorbn\\AcademicPensieve\\Projects\\OneCo-1604"];
<< Local.m
```

In the U(T)⊗U(H) conventions. Internal use symbols: {rr, pp}

Export

```
AutoAd[B_, x_][y_] :=
  Module[{pows, states, i, s, seq, sh = 5, dseq, sf1, sf2, sf, t1, n},
   pows = NestList[B[x, #] &, y, 20];
   states =
    Union[Cases[pows, s_β | s_δβ | s_a | s_δa | s_δaa :> ReplacePart[s, 1 → _], ∞]];
   UU@Sum[
     seq = Cases[{#}, states[[i]], ∞] & /@ pows;
     seq = Replace[seq, {{_[f_, ___]} :> f, {} → 0}, {1}];
     dseq = Drop[seq, sh];
     If[Union[Length[MonomialList[#]] & /@ dseq] === {1} ⋀
       Union[Length[FactorTermsList[#]] & /@ dseq] === {2},
      sf1 = FindSequenceFunction[FactorTermsList[#][[1]] & /@ dseq];
      sf2 = FindSequenceFunction[FactorTermsList[#][[2]] & /@ dseq];
      sf = (sf1[#] sf2[#] &),
      (*Else*) sf = FindSequenceFunction[dseq,
        FunctionSpace → {"ConstantRecursive", "HolonomicSequence",
          "Polynomial", "RationalFunction", "HypergeometricTerm"}]];
     ReplacePart[states[[i]], 1 → FullSimplify[Sum[seq[[n + 1]]/n!, {n, 0, sh-1}] + Sum[sf[n + 1 - sh]/n!, {n, sh, ∞}]]],
     {i, Length@states}] ];
```

HeadByTails

**AutoAd[bb[j, k], UU@a[1, j, k]][UU@a[1, 0, j]]**

HeadByTails

$$\mathrm{UU}\Big[a[1,0,j]+a\big[1-e^{-b_j},0,k\big]+a\Big[\frac{\left(-1+e^{-b_j}\right)b_0}{b_j},j,k\Big]+\delta a\Big[-1-e^{-b_j}+\frac{1-e^{-2b_j}}{b_j},0,k\Big]+\delta a\Big[b_0\left(1+\frac{-1+e^{-b_j}}{b_j}\right),ç,k\Big]+\delta a\Big[\frac{e^{-2b_j}b_0\left(1+e^{b_j}(-1+b_j)\right)}{b_j^2},j,k\Big]+\delta aa\Big[\frac{2e^{-b_j}b_0(\mathrm{Sinh}[b_j]-b_j)}{b_j^3},j,k,j,k\Big]+\delta aa\Big[\frac{b_0\left(1-e^{-b_j}-b_j\right)}{b_j^2},ç,j,j,k\Big]+\delta aa\Big[\frac{1-e^{-b_j}}{b_j},ç,k,0,j\Big]+\delta aa\Big[\frac{-1+e^{-b_j}}{b_j},ç,j,0,k\Big]+\delta aa\Big[\frac{e^{-2b_j}\left(-1-e^{b_j}(-1+b_j)\right)}{b_j},ç,k,0,k\Big]+\delta aa\Big[\frac{-1+e^{-b_j}+b_j}{b_j^2},0,j,j,k\Big]+\delta aa\Big[\frac{e^{-2b_j}\left(1+e^{2b_j}(-1+b_j)+e^{b_j}b_j\right)}{b_j^2},0,k,j,k\Big]+\delta aa\Big[-\frac{e^{-2b_j}b_0\left(-1+e^{b_j}+e^{b_j}\left(-2+e^{b_j}\right)b_j\right)}{b_j^2},ç,k,j,k\Big]\Big]$$

HeadByHeads

**AutoAd[bb[j, k], UU@a[1, j, k]][UU@a[1, 0, k]]**

HeadByHeads

$$\mathrm{UU}\Big[a\big[e^{-b_j},0,k\big]+a\Big[\frac{\left(1-e^{-b_j}\right)b_0}{b_j},j,k\Big]+\delta a\Big[\frac{e^{-2b_j}b_0\left(-1-e^{b_j}(-1+b_j)\right)}{b_j^2},j,k\Big]+\delta a\Big[\frac{e^{-2b_j}\left(1+e^{b_j}(-1+b_j)\right)}{b_j},0,k\Big]+\delta aa\Big[\frac{e^{-2b_j}\left(-1-e^{b_j}(-1+b_j)\right)}{b_j^2},0,k,j,k\Big]+\delta aa\Big[\frac{2e^{-b_j}b_0(\mathrm{Sinh}[b_j]-b_j)}{b_j^2},ç,k,j,k\Big]+\delta aa\Big[\frac{e^{-2b_j}\left(1+e^{b_j}(-1+b_j)\right)}{b_j},ç,k,0,k\Big]+\delta aa\Big[\frac{2e^{-b_j}b_0(-\mathrm{Sinh}[b_j]+b_j)}{b_j^3},j,k,j,k\Big]\Big]$$

**t1 = AutoAd[bb[j, k], UU@a[t, j, k]][UU@a[1, j, h∞]]**

$$\mathrm{UU}\Big[a[1,j,h\infty]+\delta aa[t,ç,h\infty,j,k]+\delta aa\Big[\frac{-1+e^{-t\,b_j}}{b_j},ç,k,j,h\infty\Big]+\delta aa\Big[-\frac{-1+e^{-t\,b_j}+t\,b_j}{b_j^2},j,h\infty,j,k\Big]\Big]$$

**t1 // ÅForm**

$$\mathrm{UU}\Big[a[1,j,h\infty]+aao\Big[-\frac{-1+e^{-t\,b_j}+t\,b_j}{b_j^2},j,h\infty,j,k\Big]+ca[-t,k,j,h\infty]+ca\Big[\frac{1-e^{-t\,b_j}}{b_j},h\infty,j,k\Big]\Big]$$

**t2 = AutoAd[bb[j, k], UU@a[t, j, k]][UU@a[1, k, h∞]]**

$$\mathrm{UU}\Big[\mathrm{a}\big[e^{t\,b_j}, k, h\infty\big] + \mathrm{a}\Big[-\frac{\left(-1+e^{t\,b_j}\right) b_k}{b_j}, j, h\infty\Big] + \delta\mathrm{a}\Big[\frac{\left(-1+e^{t\,b_j}\,(1-t\,b_j)\right) b_k}{b_j^2}, j, h\infty\Big] +$$
$$\delta\mathrm{a}\Big[\frac{\left(1+e^{t\,b_j}\,(-1+t\,b_j)\right) b_k}{b_j}, ç, h\infty\Big] + \delta\mathrm{aa}\Big[\frac{1-e^{-t\,b_j}}{b_j}, ç, k, j, h\infty\Big] +$$
$$\delta\mathrm{aa}\Big[\frac{-1+e^{t\,b_j}\,(1-t\,b_j)}{b_j}, ç, h\infty, k, k\Big] + \delta\mathrm{aa}\Big[\frac{1+e^{t\,b_j}\,(-1+t\,b_j)}{b_j^2}, j, h\infty, k, k\Big] +$$
$$\delta\mathrm{aa}\Big[\frac{-2\left(-1+e^{t\,b_j}\right) b_k + b_j\left(1+t\,b_k+e^{t\,b_j}\,(-1+t\,b_k)\right)}{b_j^2}, ç, h\infty, j, k\Big] +$$
$$\delta\mathrm{aa}\Big[\frac{1}{b_j^3} e^{-t\,b_j}\left(b_j + e^{2\,t\,b_j}\,(b_j + (2-t\,b_j)\,b_k) - e^{t\,b_j}\,(2\,b_k + b_j\,(2+t\,b_k))\right), j, h\infty, j, k\Big]\Big]$$

**t2 // ÅForm**

$$\mathrm{UU}\Big[\mathrm{a}\big[e^{t\,b_j}, k, h\infty\big] + \mathrm{a}\Big[-\frac{\left(-1+e^{t\,b_j}\right) b_k}{b_j}, j, h\infty\Big] + \mathrm{aao}\Big[\frac{1+e^{t\,b_j}\,(-1+t\,b_j)}{b_j^2}, j, h\infty, k, k\Big] +$$
$$\mathrm{aao}\Big[\frac{1}{b_j^3} e^{-t\,b_j}\left(b_j + e^{2\,t\,b_j}\,(b_j + (2-t\,b_j)\,b_k) - e^{t\,b_j}\,(2\,b_k + b_j\,(2+t\,b_k))\right), j, h\infty, j, k\Big] +$$
$$\mathrm{ao}\Big[\frac{\left(-1+e^{t\,b_j}\,(1-t\,b_j)\right) b_k}{b_j^2}, j, h\infty\Big] + \mathrm{ca}\Big[\frac{-1+e^{-t\,b_j}}{b_j}, h\infty, j, k\Big] +$$
$$\mathrm{ca}\Big[\frac{\left(-1+e^{t\,b_j}\right) b_k + b_j\left(-1+e^{t\,b_j}-t\,b_k\right)}{b_j^2}, k, j, h\infty\Big]\Big]$$

**AutoAd[bb[1, 2], UU@a[1, 1, 2]][UU@a[1, 2, 0]]**

$$\mathrm{UU}\Big[\mathrm{a}\big[e^{b_1}, 2, 0\big] + \mathrm{a}\Big[-\frac{\left(-1+e^{b_1}\right) b_2}{b_1}, 1, 0\Big] + \delta\mathrm{a}\Big[\frac{\left(-1-e^{b_1}\,(-1+b_1)\right) b_2}{b_1^2}, 1, 0\Big] +$$
$$\delta\mathrm{a}\Big[\frac{\left(1+e^{b_1}\,(-1+b_1)\right) b_2}{b_1}, ç, 0\Big] + \delta\mathrm{aa}\Big[\frac{1+e^{b_1}\,(-1+b_1)}{b_1^2}, 1, 0, 2, 2\Big] +$$
$$\delta\mathrm{aa}\Big[\frac{1-e^{-b_1}}{b_1}, ç, 2, 1, 0\Big] + \delta\mathrm{aa}\Big[-\frac{1+e^{b_1}\,(-1+b_1)}{b_1}, ç, 0, 2, 2\Big] +$$
$$\delta\mathrm{aa}\Big[\frac{-2\left(-1+e^{b_1}\right) b_2 + b_1\left(1+e^{b_1}\,(-1+b_2)+b_2\right)}{b_1^2}, ç, 0, 1, 2\Big] +$$
$$\delta\mathrm{aa}\Big[\frac{e^{-b_1}\left(b_1 + e^{2\,b_1}\,(b_1 - (-2+b_1)\,b_2) - e^{b_1}\,(2\,b_2 + b_1\,(2+b_2))\right)}{b_1^3}, 1, 0, 1, 2\Big]\Big]$$