Pensieve header: NOE-1 demo for Toulouse-1705, using elf conventions.

```
SetDirectory["C:\\drorbn\\AcademicPensieve\\Talks\\Toulouse-1705"];
```

Formatting

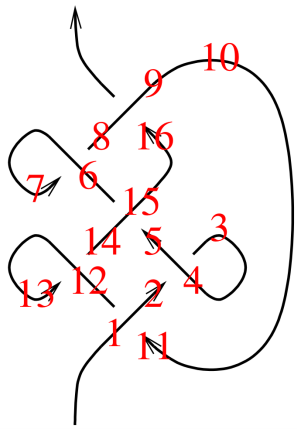
CF

```
CF[ℰ_] := Module[{vars = Union@Cases[ℰ, e_ | l_ | f_, ∞]},
   If[vars === {}, Factor[ℰ],
    Total[CoefficientRules[ℰ, vars] /. (p_ → c_) :↦ Factor[c] Times @@ (vars^p)]]];
CF[ℰ_𝔼] := CF /@ ℰ;
```

The Program and the Trefoil

Preparation

```
𝔼[i_, j_, s_] := 𝔼[1, (-1)^s l_j, (-t)^s e_i f_j, t^s e_i l_(1+s) i-s j f_j + (-1)^s l_i l_j + (-t^2)^s e_i^2 f_j^2/4];
𝔼[i_, s_] := 𝔼[1, 0, 0, s l_i];
𝔼 /: 𝔼[1, L1_, Q1_, P1_] 𝔼[1, L2_, Q2_, P2_] := 𝔼[1, L1 + L2, Q1 + Q2, P1 + P2];
```



Prep31

```
z1 = (𝔼[1, 11, 0] 𝔼[4, 2, -1] 𝔼[15, 5, 0] ×
   𝔼[6, 8, -1] 𝔼[9, 16, 0] 𝔼[12, 14, -1] ×
   𝔼[3, -1] 𝔼[7, +1] 𝔼[10, -1] 𝔼[13, +1])
```

Prep31

$$\mathbb{E}\left[1,\ -l_2+l_5-l_8+l_{11}-l_{14}+l_{16},\ -\frac{e_4 f_2}{t}+e_{15} f_5-\frac{e_6 f_8}{t}+e_1 f_{11}-\frac{e_{12} f_{14}}{t}+e_9 f_{16},\right.$$
$$-\frac{e_4^2 f_2^2}{4t^2}+\frac{1}{4}e_{15}^2 f_5^2-\frac{e_6^2 f_8^2}{4t^2}+\frac{1}{4}e_1^2 f_{11}^2-\frac{e_{12}^2 f_{14}^2}{4t^2}+\frac{1}{4}e_9^2 f_{16}^2+e_1 f_{11} l_1+\frac{e_4 f_2 l_2}{t}-l_3-l_2 l_4+l_7+$$
$$\left.\frac{e_6 f_8 l_8}{t}-l_6 l_8+e_9 f_{16} l_9-l_{10}+l_1 l_{11}+l_{13}+\frac{e_{12} f_{14} l_{14}}{t}-l_{12} l_{14}+e_{15} f_5 l_{15}+l_5 l_{15}+l_9 l_{16}\right]$$

DP

```
DP_{x_→D_α, y_→D_β}[P_][f_] :=
 Total[CoefficientRules[P, {x, y}] /. ({m_, n_} → c_) :↦ c D[f, {α, m}, {β, n}]]
```

Slx

```
S_{l_j_ (x:e|f)_i_→k_}[𝔼[ω_, L_, Q_, P_]] := With[{λ = ∂_{l_j} L, α = ∂_{x_i} Q, q = e^γ β x_k + γ l_k},
   CF[𝔼[ω, L /. l_j → l_k, t^λ α x_k + (Q /. x_i → 0), e^-q DP_{l_j→D_γ, x_i→D_β}[P][e^q] /. {β → α / ω, γ → λ Log[t]}]]];
```

Logos

```
Λ[k_] := ((t - 1) (2 (α β + δ μ)^2 - α^2 β^2) - 4 e_k l_k f_k δ^2 μ^2 -
      δ (1 + μ) (f_k^2 α^2 + e_k^2 β^2) - e_k^2 f_k^2 δ^3 (1 + 3 μ) -
      2 (α β + 2 δ μ + e_k f_k δ^2 (1 + 2 μ) + 2 l_k δ μ^2) (f_k α + e_k β) - 4 (l_k μ^2 + e_k f_k δ (1 + μ)) (α β + δ μ)) (1 + t) / 4;
```

Sfe

```
S_{f_i_ e_j_ → k_}[𝔼[ω_, L_, Q_, P_]] := With[{q = ((1 - t) α β + β e_k + α f_k + δ e_k f_k) / μ}, CF[
    𝔼[μ ω, L, μ ω q + μ (Q /. f_i | e_j → 0), μ^4 e^-q DP_{f_i → D_α, e_j → D_β}[P][e^q] + ω^4 Λ[k]] /. μ → 1 + (t - 1) δ /.
     {α → ω^-1 (∂_{f_i} Q /. e_j → 0), β → ω^-1 (∂_{e_j} Q /. f_i → 0), δ → ω^-1 ∂_{f_i, e_j} Q}]];
```

m

```
m_{i_, j_ → k_}[Z_𝔼] := Module[{x, z},
  CF[(Z // S_{f_i e_j → x} // S_{l_i e_x → x} // S_{f_x l_j → x}) /. z_{i_ | j_ | x} → z_k]]
```

E31

```
(Do[z1 = z1 // m_{1, k → 1}, {k, 2, 16}]; z1)
```

E31

$$\mathbb{E}\left[\frac{1-t+t^2}{t}, 0, 0, \frac{(-1+t)(1-t+t^2)^2(1-t+2t^2)}{t^3} - \frac{2(1+t)(1-t+t^2)^3 e_1 f_1}{t^4} - \frac{2(-1+t)(1+t)(1-t+t^2)^3 l_1}{t^4}\right]$$

rho1

```
ρ_1[𝔼[ω_, _, _, P_]] := CF[(t ((P /. e_ | l_ | f_ → 0) - t ω^3 (∂_t ω))) / ((t - 1)^2 ω^2)]
```

rho131

```
ρ_1[z1] // Expand
```

rho131

$$\frac{1}{t} + t$$

Exporting the above as PDF files

The below is adapted from pensieve://2016-04/GaussGassner/GaussGassnerDemo.nb.

```
ConditionalExport[fname_String, rest___] := Module[{temp, exists},
  temp = "ConditionalExportTemporary" <> "." <> FileExtension[fname];
  exists = FileExistsQ[fname];
  Export[temp, rest];
  If[exists && FileByteCount[fname] === FileByteCount[temp],
   DeleteFile[temp],
   (* else *) Print["Exporting " <> fname <> "..."];
   If[exists, DeleteFile[fname]];
   RenameFile[temp, fname]
  ];
  fname
 ]

SetOptions[$FrontEndSession, PrintingStyleEnvironment → "Working"];
TagProperties[_] := {};
TagProperties["131"] = {PageWidth → 3.2 / 0.66};
Options[CellExport] = {
   PageWidth → 4 / 0.66, CellFilter → Identity, ExportDirectory → "Snips",
   ExportBaseFilename → Automatic, ExportFormat → ".pdf", ExportOptions → {}, Split → False
  };
CellExport[tag_String, opts___Rule] := CellExport[
```

```
    NotebookGet[EvaluationNotebook[]],
    tag, opts
   ];
CellExport[nb_Notebook, tag_String] := CellExport[nb, tag, TagProperties[tag]];
CellExport[nb_Notebook, tag_String, OptionsPattern[]] := Module[
    {cells, cell, filename, format},
    filename = FileNameJoin[{
       OptionValue[ExportDirectory] /. Automatic → Directory[],
       OptionValue[ExportBaseFilename] /. Automatic → tag
      }];
    format = OptionValue[ExportFormat];
    cells = OptionValue[CellFilter][Cases[
       nb, c_Cell /; FreeQ[List @@ c, Cell] && ! FreeQ[c, CellTags → tag],
       Infinity
      ]];
    If[! OptionValue[Split],
     If[Length[cells] ≥ 1,
      If[Length[cells] == 1,
       cells = Join[First[cells],
         Cell[PageWidth → 1.2 × 72 OptionValue[PageWidth], Background → {White, Opacity[0]}]],
       cells = Cell[CellGroup[cells], PageWidth → 72 OptionValue[PageWidth]]
      ];
      ConditionalExport[
       filename <> format, cells,
       ImageResolution → 300,
       OptionValue[ExportOptions]
      ]
     ],
     k = 0;
     Table[
      ++k;
      ConditionalExport[
       filename <> "-" <> ToString[k] <> format,
       Append[cell, PageWidth → 72 OptionValue[PageWidth]],
       ImageResolution → 300,
       OptionValue[ExportOptions]
      ],
      {cell, cells}
     ]
    ]
   ];

ExportCells := (
    nb = NotebookGet[EvaluationNotebook[]];
    tags = Cases[nb, (CellTags → tag_String) :↦ tag, Infinity] // Union;
    Print[tags];
    CellExport /@ tags;
    Print["Done."]
   );
```

```
ExportCells
```

```
{CF, DP, E31, Logos, m, Prep31, Preparation, rho1, rho131, Sfe, Slx}

Exporting Snips\CF.pdf...

Exporting Snips\Logos.pdf...

Exporting Snips\m.pdf...

Exporting Snips\Preparation.pdf...

Exporting Snips\rho1.pdf...

Exporting Snips\Sfe.pdf...

Exporting Snips\Slx.pdf...

Done.
```