Pensieve header: The Objects.

Program

The Objects

Program

"Define" code

Program

Define[lhs = rhs, ...] defines the lhs to be rhs, except that rhs is computed only once for each value of $k. Fancy Mathematica not for the faint of heart. Most readers should ignore.

Program

In[ ]:=
```
SetAttributes[Define, HoldAll];
Define[def_, defs__] := (Define[def]; Define[defs];);
Define[op_is__ = ℰ_] := Module[{SD, ii, jj, kk, isp, nis, nisp, sis}, Block[{i, j, k},
   ReleaseHold[Hold[
      SD[op_nisp,$k_Integer, PP_Boot@Block[{i, j, k}, op_isp,$k = ℰ; op_nis,$k]];
      SD[op_isp, op_{is},$k]; SD[op_sis__, op_{sis}];
     ] /. {SD → SetDelayed,
      isp → {is} /. {i → i_, j → j_, k → k_},
      nis → {is} /. {i → ii, j → jj, k → kk},
      nisp → {is} /. {i → ii_, j → jj_, k → kk_}
     }] ]]
```

Program

Booting Up QU

Program

```
Define[am_{i,j→k} = 𝔼_{{i,j}→{k}}[(α_i + α_j) a_k, (𝒜_j^-1 ξ_i + ξ_j) x_k, 1]_$k,
 bm_{i,j→k} = 𝔼_{{i,j}→{k}}[(β_i + β_j) b_k, (η_i + η_j) y_k, ℯ^((ℯ^-ϵ β_i - 1) η_j y_k)]_$k]
```

Program

In[ ]:=
```
Define[R_{i,j} = CF@𝔼_{{}→{i,j}}[ħ a_j b_i, ħ x_j y_i, ℯ^(Sum[(1 - ℯ^γ∈ħ)^k (ħ y_i x_j)^k / (k (1 - ℯ^k γ∈ħ)), {k, 2, $k+1}])]_$k,
 R̄_{i,j} = CF@𝔼_{{}→{i,j}}[-ħ a_j b_i, -ħ x_j y_i / B_i, 1 + If[$k == 0, 0, (R̄_{{i,j},$k-1})$k[3] -
       (((R̄_{{i,j},0})$k R_{1,2} (R̄_{{3,4},$k-1})$k) // (bm_{i,1→i} am_{j,2→j}) // (bm_{i,3→i} am_{j,4→j}))[3]]],
 P_{i,j} = 𝔼_{{i,j}→{}}[β_i α_j / ħ, η_i ξ_j / ħ, 1 + If[$k == 0, 0, (P_{{i,j},$k-1})$k[3] -
       (R_{1,2} // ((P_{{1,j},0})$k (P_{{i,2},$k-1})$k))[3]]]]
```

Program

In[ ]:=
```
Define[aS_j = R̄_{i,j}~B_i~P_{i,j},
 ā_i = 𝔼_{{i}→{i}}[-a_i α_i, -x_i 𝒜_i ξ_i, 1 + If[$k == 0, 0, (ā_{{i},$k-1})$k[3] -
       ((ā_{{i},0})$k ~B_i~aS_i~B_i~ (ā_{{i},$k-1})$k)[3]]]]
```

Program

```
In[ ]:= Define[bS_i = R_{i,1} ~ B_1 ~ aS_1 ~ B_1 ~ P_{i,1},
  bS̄_i = R_{i,1} ~ B_1 ~ āS_1 ~ B_1 ~ P_{i,1},
  aΔ_{i→j,k} = (R_{1,j} R_{2,k}) // bm_{1,2→3} // P_{3,i},
  bΔ_{i→j,k} = (R_{j,1} R_{k,2}) // am_{1,2→3} // P_{i,3}]
```

Program

```
Define[dm_{i,j→k} = (𝔼_{{i,j}→{i,j}}[β_i b_i + α_j a_j, η_i y_i + ξ_j x_j, 1]
      (aΔ_{i→1,2} // aΔ_{2→2,3} // āS_3) (bΔ_{j→-1,-2} // bΔ_{-2→-2,-3})) // (P_{-1,3} P_{-3,1} am_{2,j→k} bm_{i,-2→k}),
  dS_i = 𝔼_{{i}→{1,2}}[β_i b_1 + α_i a_2, η_i y_1 + ξ_i x_2, 1] // (bS̄_1 aS_2) // dm_{2,1→i},
  dS̄_i = 𝔼_{{i}→{1,2}}[β_i b_1 + α_i a_2, η_i y_1 + ξ_i x_2, 1] // (bS_1 āS_2) // dm_{2,1→i},
  dΔ_{i→j,k} = (bΔ_{i→3,1} aΔ_{i→2,4}) // (dm_{3,4→k} dm_{1,2→j})]
```

Program

```
In[ ]:= Define[C_i = 𝔼_{{}→{i}}[0, 0, B_i^{1/2} e^{-ħ ϵ a_i/2}]_{$k},
  C̄_i = 𝔼_{{}→{i}}[0, 0, B_i^{-1/2} e^{ħ ϵ a_i/2}]_{$k},
  Kink_i = (R_{1,3} C̄_2) // dm_{1,2→1} // dm_{1,3→i},
  K̄ink_i = (R̄_{1,3} C_2) // dm_{1,2→1} // dm_{1,3→i}]
```

Program

Note. $t == \epsilon a - \gamma b$ and $b == -t/\gamma + \epsilon a/\gamma$.

Program

```
In[ ]:= Define[b2t_i = 𝔼_{{i}→{i}}[α_i a_i - β_i t_i / γ, ξ_i x_i + η_i y_i, e^{ϵ β_i a_i/γ}]_{$k},
  t2b_i = 𝔼_{{i}→{i}}[α_i a_i - τ_i γ b_i, ξ_i x_i + η_i y_i, e^{ϵ τ_i a_i}]_{$k}]
```

Program

The CU Definitions

Program

```
In[ ]:= Define[cm_{i,j→k} = CF@𝔼_{{i,j}→{k}}[
      a_k (α_i + α_j) + b_k (β_i + β_j),
      y_k (η_i + η_j/𝒜_i) + γ b_k η_j ξ_i + x_k (ξ_i/𝒜_j + ξ_j),
      e^{y_k η_j (e^{-ϵ β_i}/(𝒜_i + γ ϵ 𝒜_i η_j ξ_i) - 1/𝒜_i) + ξ_i (x_k (e^{-ϵ β_j}/(𝒜_j + γ ϵ 𝒜_j η_j ξ_i) - 1/𝒜_j) - γ b_k η_j)} (1 + γ ϵ η_j ξ_i)^{a_k/γ + b_k/ϵ}
    ]_{$k}]
```

Program

```
In[ ]:= Define[cΔ_{i→j,k} = 𝔼_{{i}→{j,k}}[(a_j + a_k) α_i + (b_j + b_k) β_i, (y_j + y_k) η_i + (x_j + x_k) ξ_i, 1]_{$k}]
```

Program

```
In[ ]:= Define[cS_i = 𝔼_{{i}→{1,2,3,4}}[-β_i b_2 - α_i a_3, -η_i y_1 - ξ_i x_4, 1] // cm_{4,3→i} // cm_{i,2→i} // cm_{i,1→i}]
```

Program

The Knot Tensors

Program

In[•]:=

```
Define[kR_{i,j} = R_{i,j} // (b2t_i b2t_j) /. t_{i|j} → t,
 kR̄_{i,j} = R̄_{i,j} // (b2t_i b2t_j) /. {t_{i|j} → t, T_{i|j} → T},
 km_{i,j→k} = (t2b_i t2b_j) // dm_{i,j→k} // b2t_k /. {t_k → t, T_k → T, τ_{i|j} → 0},
 kC_i = C_i // b2t_i /. T_i → T,
 kC̄_i = C̄_i // b2t_i /. T_i → T,
 kKink_i = Kink_i // b2t_i /. {t_i → t, T_i → T},
 kKink̄_i = Kink̄_i // b2t_i /. {t_i → t, T_i → T}]
```