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E2[n_, k_, s_, b_] := Sum[ j^(-s) E2[n / j, k-1, s, b], {j, 2, n}] -
  b Sum[ (j b)^(-s) E2[n / (b j), k-1, s, b], {j, 1, n / b}]; E2[n_, 0, s_, b_] := 1
E1[n_, k_, s_, b_] := Sum[FactorialPower[k, a] / a! E2[n, a, s, b],
  {a, 0, Log[If[b > 2, 2, b], n]}]
D1[n_, k_, s_, b_] := Sum[ Binomial[k+j-1, k-1] b^(j (1-s)) E1[n / b^j, k, s, b],
  {j, 0, Log[b, n]}]
D1a[n_, k_, s_, b_] := Sum[ Binomial[k+j-1, k-1] b^(j (1-s))
  Sum[FactorialPower[k, a] / a! E2[n / b^j, a, s, b],
  {a, 0, Log[If[b > 2, 2, b], n / b^j]}], {j, 0, Log[b, n]}]
D1b[n_, k_, s_, b_] := Sum[Binomial[k+j-1, k-1] FactorialPower[k, a] / a! b^(j (1-s))
  E2[n / b^j, a, s, b], {j, 0, Log[b, n]}, {a, 0, Log[If[b > 2, 2, b], n / b^j]}]

D1c[n_, k_, s_, a_] :=
  Sum[Binomial[k+j-1, k-1] Binomial[k, m] a^(j (1-s)) E2[n / a^j, m, s, a],
  {j, 0, Log[a, n]}, {m, 0, Log[If[a > 2, 2, a], n / a^j]}]

D1ba[n_, k_, s_, b_] := Grid[
  Table[Binomial[k+j-1, k-1] FactorialPower[k, a] / a! b^(j (1-s)) E2s[n / b^j, a, s, b],
  {j, 0, Log[b, n]}, {a, 0, Log[If[b > 2, 2, b], n / b^j]}]]
D1ba2[n_, k_, s_, b_] := Grid[Table[Binomial[k+j-1, k-1] FactorialPower[k, a] / a!
  b^(j (1-s)), {j, 0, Log[b, n]}, {a, 0, Log[If[b > 2, 2, b], n / b^j]}]]
D1bb[n_, k_, s_, b_] := Grid[Table[Binomial[k+j-1, k-1]
  FactorialPower[k, a] / a! b^(j (1-s)) E2s[n / b^j, a, s, b] / k,
  {j, 0, Log[b, n]}, {a, 0, Log[If[b > 2, 2, b], n / b^j]}]]
D1bb2[n_, k_, s_, b_] := Grid[Table[Binomial[k+j-1, k-1] FactorialPower[k, a] / a!
  b^(j (1-s)) / k, {j, 0, Log[b, n]}, {a, 0, Log[If[b > 2, 2, b], n / b^j]}]]

D1[100, 1, 0, 100]

100

(D1c[100, 0.00001, 0, 100] - 1) / 0.00001

28.5338

D1ba[100, -1, 0, 2]

E2s[100,      -E2s[100,      E2s[100,      -E2s[100,      E2s[100,      -E2s[100,      E2s[100,
  0, 0, 2]      1, 0, 2]      2, 0, 2]      3, 0, 2]      4, 0, 2]      5, 0, 2]      6, 0, 2]
-2 E2s[50,    2 E2s[50,    -2 E2s[50,    2 E2s[50,    -2 E2s[50,    2 E2s[50,
  0, 0, 2]      1, 0, 2]      2, 0, 2]      3, 0, 2]      4, 0, 2]      5, 0, 2]
      0              0              0              0              0
      0              0              0              0
      0              0              0
      0              0
      0

D1ba2[100, 1, 1, 2]

1 1 0 0 0 0 0
1 1 0 0 0 0
1 1 0 0 0
1 1 0 0
1 1 0
1 1
1

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D1bb[100, 0.0000001, 0, 2]

$1. \times 10^7$	$1. \text{E2s}[100,$	-0.5	0.333333	-0.25	$0.2 \text{E2s}[100,$	-0.166667
$\text{E2s}[100,$	$1, 0, 2]$	$\text{E2s}[100,$	$\text{E2s}[100,$	$\text{E2s}[100,$	$5, 0, 2]$	$\text{E2s}[100,$
$0, 0, 2]$		$2, 0, 2]$	$3, 0, 2]$	$4, 0, 2]$		$6, 0, 2]$
$2. \text{E2s}[50,$	$2. \times 10^{-7}$	$-1. \times 10^{-7}$	$6.66667 \times$	$-5. \times 10^{-8}$	$4. \times 10^{-8}$	
$0, 0, 2]$	$\text{E2s}[50,$	$\text{E2s}[50,$	10^{-8}	$\text{E2s}[50,$	$\text{E2s}[50,$	
	$1, 0, 2]$	$2, 0, 2]$	$\text{E2s}[50,$	$4, 0, 2]$	$5, 0, 2]$	
			$3, 0, 2]$			
$2. \text{E2s}[25,$	$2. \times 10^{-7}$	$-1. \times 10^{-7}$	$6.66667 \times$	$-5. \times 10^{-8}$		
$0, 0, 2]$	$\text{E2s}[25,$	$\text{E2s}[25,$	10^{-8}	$\text{E2s}[25,$		
	$1, 0, 2]$	$2, 0, 2]$	$\text{E2s}[25,$	$4, 0, 2]$		
			$3, 0, 2]$			
2.66667	$2.66667 \times$	$-1.33333 \times$	$8.88889 \times$			
$\text{E2s}[\frac{25}{2},$	10^{-7}	10^{-7}	10^{-8}			
$0, 0, 2]$	$\text{E2s}[\frac{25}{2},$	$\text{E2s}[\frac{25}{2},$	$\text{E2s}[\frac{25}{2},$			
	$1, 0, 2]$	$2, 0, 2]$	$3, 0, 2]$			
$4. \text{E2s}[\frac{25}{4},$	$4. \times 10^{-7}$	$-2. \times 10^{-7}$				
$0, 0, 2]$	$\text{E2s}[\frac{25}{4},$	$\text{E2s}[\frac{25}{4},$				
	$1, 0, 2]$	$2, 0, 2]$				
$6.4 \text{E2s}[\frac{25}{8},$	6.4×10^{-7}					
$0, 0, 2]$	$\text{E2s}[\frac{25}{8},$					
	$1, 0, 2]$					
10.6667						
$\text{E2s}[\frac{25}{16},$						
$0, 0, 2]$						

D1bb2[100, 0.0000001, -1, 2]

$1. \times 10^7$	$1.$	-0.5	0.333333	-0.25	0.2	-0.166667
$4.$	$4. \times 10^{-7}$	$-2. \times 10^{-7}$	1.33333×10^{-7}	$-1. \times 10^{-7}$	$8. \times 10^{-8}$	
$8.$	$8. \times 10^{-7}$	$-4. \times 10^{-7}$	2.66667×10^{-7}	$-2. \times 10^{-7}$		
21.3333	2.13333×10^{-6}	-1.06667×10^{-6}	7.11111×10^{-7}			
$64.$	6.4×10^{-6}	-3.2×10^{-6}				
204.8	0.00002048					
682.667						