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DD[k_, a_, n_] :=
  Sum[Binomial[k, j] DD[k - j, m + 1, Floor[n / (m^j)]], {m, a, n^(1/k)}, {j, 1, k}]
DD[1, a_, n_] := Floor[n] - a + 1
DD[0, a_, n_] := 1
DS[n_, k_] := DD[k, 2, n]
DDD[n_, k_] := Sum[DDD[n / j, k - 1], {j, 2, n}]
DDD[n_, 0] := 1
D2[1, a_, n_, p_, r_] := n - a + 1
D2[2, a_, n_, p_, r_] := p / ((r + 1) (r + 2)) + (Floor[n / a] - a) (p / (r + 1)) +
  (Floor[n^(1/2)] - a) (p / 2) + p Sum[Floor[n / m] - m, {m, a + 1, n^(1/2)}]
D2[k_, a_, n_, p_, r_] := D2[k - 1, a, n / a, p / (r + 1), r + 1] +
  Sum[D2[k - 1, m, n / m, p, 1], {m, a + 1, n^(1/k)}]
DD2[n_, k_] := D2[k, 2, n, k!, 0]
D3[1, a_, n_, p_, r_] := p / (r + 1) + p (Floor[n] - a)
D3[k_, a_, n_, p_, r_] :=
  D3[k - 1, a, n / a, p / (r + 1), r + 1] + Sum[D3[k - 1, m, n / m, p, 1], {m, a + 1, n^(1/k)}]
DD3[n_, k_] := D3[k, 2, n, k!, 0]
D4[1, a_, n_, p_, r_] := p (Floor[n] - a + 1) - p / (r + 1)
D4[k_, a_, n_, p_, r_] :=
  Sum[D4[k - 1, m, n / m, p, 1], {m, a, n^(1/k)}] - D4[k - 1, a, n / a, p / (r + 1), r + 1]
DD4[n_, k_] := D4[k, 1, n, k!, 0]

DDD[1000, 4]

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DD4[1000, 4]

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D5[1, a_, n_, p_, r_, s_] := s! / p / (r + 1) + (s! / p) (Floor[n] - a)
D5[k_, a_, n_, p_, r_, s_] := D5[k - 1, a, n / a, p (r + 1), r + 1, s + 1] +
  Sum[D5[k - 1, m, n / m, p, 1, s + 1], {m, a + 1, n^(1/k)}]
DD5[n_, k_] := D5[k, 2, n, 1, 0, 1]

DD5[1000, 3]

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DDD[1000, 3]

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D6[1, a_, n_, p_, r_, s_] := p + (p (r + 1)) (Floor[n] - a)
D6[k_, a_, n_, p_, r_, s_] := D6[k - 1, a, n / a, p, 1, s + 1] +
  Sum[D6[k - 1, m, n / m, p (r + 1), r + 1, s + 1], {m, a + 1, n^(1/k)}]
DD6[n_, k_] := D6[k, 2, n, 1, 0, 1]

DD6[1000, 3]

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DA[1, n_, a_, k_, p_, r_] := (p / r + p (Floor[n] - a))
DA[s_, n_, a_, k_, p_, r_] := DA[s - 1, n / a, a, k + 1, kp / r, r + 1] +
  Sum[DA[s - 1, n / m, m, k + 1, kp, 2], {m, a + 1, n^(1/s)}]
DDA[n_, s_] := DA[s, n, 2, 2, 1, 1]

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DDD[1000, 3]
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DDA[1000, 3]
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DB[1, n_, a_, k_, p_, r_] := p (Floor[n] - a + 1) - p / r
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DB[s_, n_, a_, k_, p_, r_] := Sum[DB[s-1, n/m, m, k+1, kp, 2], {m, a, n^(1/s)}] -  
  DB[s-1, n/a, a, k+1, kp/r, r+1]
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DDB[n_, s_] := DB[s, n, 1, 2, 1, 1]
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DDD[1000, 3]
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DDB[1000, 3]
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D7[a_, n_, p_, r_, s_] :=
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(s! / p / r + (s! / p) (Floor[n] - a)) / s -
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If[n^(1/2) ≥ a, D7[a, n/a, pr, r+1, s+1] +
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Sum[D7[m, n/m, p, 2, s+1], {m, a+1, n^(1/2)}], 0]
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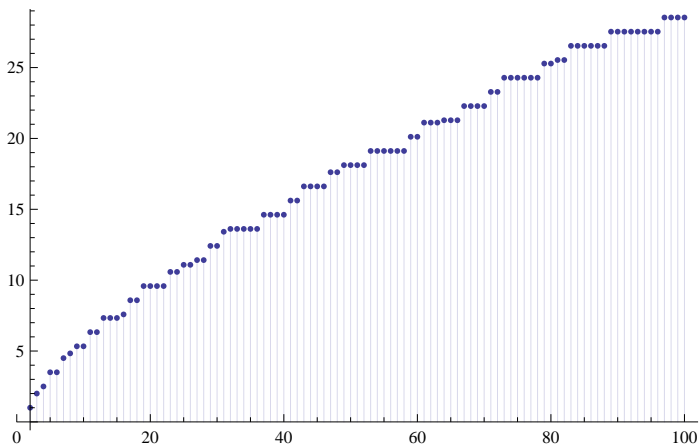
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DD7[n_] := D7[2, n, 1, 1, 1]
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DD7[100]
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DiscretePlot[DD7[n], {n, 2, 100}]
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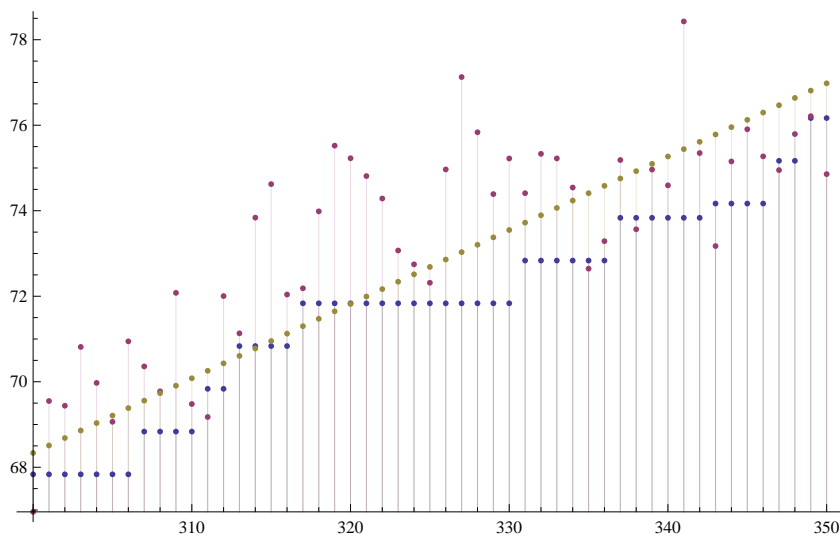


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D8[s_, n_, a_, k_, p_, r_] :=
  p (Floor[n/s] * s - a + 1/r) -
  If[n^(1/2) ≥ a,
    Sum[D8[s, n/m, m, k+1, kp/r, r+1] * s, {m, a, a+.999999, s}], 0] -
  Sum[D8[s, n/m, m, k+1, kp, 2] * s, {m, a+1, n^(1/2), s}]
DD8[n_, s_] := D8[s, n, 1+s, 1, 1, 1]

D8a[n_, a_, k_, p_, r_] :=
  p (Floor[n] - a + 1/r) -
  If[n^(1/2) ≥ a, D8a[n/a, a, k+1, kp/r, r+1], 0] -
  Sum[D8a[n/m, m, k+1, kp, 2], {m, a+1, n^(1/2)}]
DD8a[n_] := D8a[n, 2, 1, 1, 1]
DiscretePlot[{DD8a[n], DD8[n, .1], LogIntegral[n]}, {n, 300, 350}]

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DD8a[100]
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DD9[n_, k_, a_] :=
  Sum[(-1)^(j-1) Binomial[k, j] DD9[n/(m^j), k-j, m], {j, 1, k}, {m, a, n^(1/k)}]
DD9[n_, 0, a_] := 1
DD9[1000, 5, 2]
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DDD[1000, 5]
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DiscretePlot[DD9[n, 4, 2], {n, 2, 1000}]

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