```
NEdistW[n_, p_, q_: 1, t_, opts___] :=
 Module[{d, pr1, pr2, pr3, adn, func, st, v, rj, a, xr, prd},
  Options[NEdistW] = {dist → 1, prcm → 300,
    prcpar → 200, prcf → 16, ad → 0, function → 1, stat → 1};
  d = dist /. {opts} /. Options[NEdistW];
  pr1 = prcm /. {opts} /. Options[NEdistW];
  pr2 = prcf /. {opts} /. Options[NEdistW];
  pr3 = prcpar /. {opts} /. Options[NEdistW];
  adn = ad /. {opts} /. Options[NEdistW];
  func = function /. {opts} /. Options[NEdistW];
  st = stat /. {opts} /. Options[NEdistW];
  v = IntModule[n, p, q, st, d, pr1, pr3, adn];
  rj = If[st == 1, Rj1[n, p],
    If[st == 2, Rj1[n, p - {0, 1}], If[st == 3, Rj3[n, p], Rj4[n, p, q]]]];
  g = If[st == 1, g = Total[p], If[st == 2, g = Total[p] - 1, g = p]];
  a = Table[(n - j) / n, {j, 2, g}];
  xr = Rationalize[t, 0];
  If[func == 3,
   prd = Product[a[[j]]^rj[[j]] * (a[[j]] - I * xr)^(-rj[[j]]), {j, 1, g - 1}];
   If[d == 2, (v[[1]] * v[[4]]^v[[2]] * (v[[4]] - I * xr)^(-v[[2]]) +
       (1 - v[[1]]) * v[[4]]^v[[3]] * (v[[4]] - I * xr)^(-v[[3]])) * prd,
    If[d == 3, (v[[1]] * v[[6]]^v[[3]] * (v[[6]] - I * xr)^(-v[[3]]) +
        v[[2]] * v[[6]]^v[[4]] * (v[[6]] - I * xr)^(-v[[4]]) +
        (1 - v[[1]] - v[[2]]) * v[[6]]^v[[5]] * (v[[6]] - I * xr)^(-v[[5]])) * prd,
     v[[2]]^v[[1]] * (v[[2]] - I * xr)^(-v[[1]]) * prd]],
   If[func == 2, GNIG[r_, b_, l_, a_, w_] := GNIGpdf[r, b, l, a, w],
    GNIG[r_, b_, l_, a_, w_] := GNIGcdf[r, b, l, a, w]];
   If[d == 2, SetPrecision[v[[1]] * GNIG[rj, v[[2]], a, v[[4]], xr] +
      (1 - v[[1]]) * GNIG[rj, v[[3]], a, v[[4]], xr], pr2],
    If[d == 3, SetPrecision[v[[1]] * GNIG[rj, v[[3]], a, v[[6]], xr] +
       v[[2]] * GNIG[rj, v[[4]], a, v[[6]], xr] +
       (1 - v[[1]] - v[[2]]) * GNIG[rj, v[[5]], a, v[[6]], xr], pr2],
     SetPrecision[GNIG[rj, v[[1]], a, v[[2]], xr], pr2]]]       ]


IntModule[n_, p_, q_: 1, st_, d_, pr1_: 300, pr3_, adn_] := Module[{mm},
  mm = Table[
    SetPrecision[If[st == 1, MomPhi21[n, p, h], If[st == 2, MomPhi21[n, p - {0, 1}, h],
       If[st == 3, MomPhi23[n, p, h], MomPhi24[n, p, q, h]]]], pr1], {h, 1, 2 * d}];
  If[d == 1, Module1[mm], If[d == 2, Module2[mm], Module3[mm, pr3, adn]]]          ]

MomPhi21[n_, p_, h_] := I^(-h) * D[Phi21[n, p, t], {t, h}] /. t → 0

Phi21[n_, pk_, t_] := Module[{p, kstar},
  p = Total[pk];
  kstar = Floor[Count[pk, _?OddQ] / 2];
  (Gamma[(n - 1) / 2] * Gamma[n / 2 - 1 - n / 2 * I * t] /
      (Gamma[n / 2 - 1] * Gamma[(n - 1) / 2 - n / 2 * I * t]))^kstar   ]
```

```
MomPhi23[n_, p_, h_] := I^(-h) * D[Phi23[n, p, t], {t, h}] /. t → 0

Phi23[n_, p_, t_] :=
 Product[Gamma[(n - 1) / 2 + (j - 1) / p] * Gamma[(n - 1) / 2 - n / 2 * I * t] /
     (Gamma[(n - 1) / 2 + (j - 1) / p - n / 2 * I * t] * Gamma[(n - 1) / 2]),
   {j, 1, p - Floor[p / 2]}] * Product[Gamma[(n - 1) / 2 + (j - 1) / p] *
    Gamma[n / 2 - n / 2 * I * t] / (Gamma[(n - 1) / 2 + (j - 1) / p - n / 2 * I * t] * Gamma[n / 2]),
   {j, 1 + p - Floor[p / 2], p}]

MomPhi24[n_, p_, q_, h_] := I^(-h) * D[Phi24[n, p, q, t], {t, h}] /. t → 0

Phi24[n_, p_, q_, t_] := Module[{aj, bjk, bjks, bpks},
  aj = Table[n - 1, {j, 1, Floor[p / 2]}];
  bjk = Table[Table[(k - 2 * j) / q, {k, 1, q}], {j, 1, Floor[p / 2]}];
  bjks = Floor[bjk];
  ap = (n - 1) / 2;
  bpk = Table[(2 * k - p - 1) / (2 * q), {k, 1, q}];
  bpks = Floor[bpk];
  Product[
    Product[Gamma[aj[[j]] + bjk[[j, k]]] * Gamma[aj[[j]] + bjks[[j, k]] - n * I * t] /
       (Gamma[aj[[j]] + bjks[[j, k]]] * Gamma[aj[[j]] + bjk[[j, k]] - n * I * t]),
     {k, 1, q}], {j, 1, Floor[p / 2]}] *
   (Product[Gamma[ap + bpk[[k]]] * Gamma[ap + bpks[[k]] - n / 2 * I * t] / (Gamma[
          ap + bpks[[k]]] * Gamma[ap + bpk[[k]] - n / 2 * I * t]), {k, 1, q}]) ^Mod[p, 2]
 ]


Module1[mm_] := {mm[[1]]^2 / (mm[[2]] - mm[[1]]^2), mm[[1]] / (mm[[2]] - mm[[1]]^2)}

Module2[mm_] := Module[{},
  Sort[Cases[{p1, r1, r2, m} /.
      NSolve[Table[mm[[h]] == MomMixGam[{p1}, {r1, r2}, {m, m}, h], {h, 1, 4}],
       {p1, r1, r2, m}], {_Real, _Real, _Real, _Real}]][[2]]
 ]

Module3[mm_, prcpar_: 200, ad_: 0] := Module[{vecn},
  vecn = Module2[p, q, n, prcm];
  {p1, p2, r1, r2, r3, m} /. FindRoot[
    Table[mm[[h]] == MomMixGam[{p1, p2}, {r1, r2, r3}, {m, m, m}, h], {h, 1, 6}],
    {p1, vecn[[1]]}, {p2, .99 * (1 - vecn[[1]])}, {r1, vecn[[2]]}, {r2, vecn[[3]]},
    {r3, ad + 2 * vecn[[3]] - vecn[[2]]}, {m, vecn[[4]]}, WorkingPrecision → prcpar]
 ]

MomMixGam[p_, r_, m_, h_] := Module[{nt, ptot},
  nt = Length[r];
  ptot = Total[p];
  (1 - ptot) * Product[r[[nt]] + i, {i, 0, h - 1}] * m[[nt]]^(-h) +
   Sum[p[[j]] * Product[r[[j]] + i, {i, 0, h - 1}] * m[[j]]^(-h), {j, 1, nt - 1}]
 ]
```

```
Rj1[n_, pk_] := Module[{p, kstar, hj},
  p = Total[pk];
  kstar = Floor[Count[pk, _?OddQ] / 2];
  hj = Table[Count[pk - (j - 1), _?Positive], {j, 1, p - 2}] - 1;
  rj = Table[0, {j, 1, p}];
  rj[[3]] = hj[[1]] - kstar; rj[[4]] = hj[[2]] + kstar;
  Do[rj[[j]] = rj[[j - 2]] + hj[[j - 2]], {j, 5, p}];
  Drop[rj, 1]
 ]

Rj3[n_, p_] := Table[Floor[(p - j + 2) / 2], {j, 2, p}]

Rj4[n_, p_, q_] := Module[{a, a1, a2, p2, q2},
  a = Floor[(p - 1) / q];
  a1 = Floor[(q - 1) / q * (p - 1) / 2]; a2 = Floor[(q - 1) / q * (p + 1) / 2];
  p2 = Floor[p / 2]; q2 = Floor[q / 2];
  rj = Table[0, {j, 1, p - 1}];
  Do[
   rj[[j]] = q2 * ((j - 1) * q - 2 * Mod[q + 1, 2] * Floor[j / 2] + Floor[(q + Mod[j, 2]) / 2]),
   {j, 1, a}];
  rj[[a + 1]] = -(p2 - a * q2) ^ 2 + q * (p2 - Floor[(a + 1) / 2]) +
    Mod[q, 2] * (a * p2 + Mod[a, 2] / 4 - a ^ 2 / 4 - a ^ 2 * q2);
  Do[rj[[j]] = q * (p2 - Floor[j / 2]), {j, a + 2, Min[p - 2 * a1, p - 1]}];
  Do[rj[[j]] = q * (p2 - Floor[j / 2]), {j, 2 + p - 2 * a1, 2 * p2 - 1, 2}];
  Do[rj[[j]] = q * (Floor[(p + 1) / 2] - Floor[j / 2]), {j, 1 + p - 2 * a1, p - 1, 2}];
  rj[[p - 1 - 2 * a1]] =
   rj[[p - 1 - 2 * a1]] + Mod[p, 2] * (a2 - a1) * (q - (p - 1) / 2 + q * Floor[p / (2 * q)]);
  rj
 ]

GNIGpdf[r_, b_, l_, a_, w_] := Module[{g, c},
  If[Count[r, _Integer] == Length[r] && And @@ Positive[r] && And @@ Positive[l],
   g = Length[r];
   c = Makec[r, l, g];
   Product[l[[j]] ^ r[[j]], {j, 1, g}] *
    a ^ b * Sum[Exp[-l[[j]] * w] * Sum[c[[j]][[k]] *
    Gamma[k] / Gamma[k + b] * w ^ (k + b - 1) *
        Hypergeometric1F1[b, k + b, -(a - l[[j]]) * w],
    {k, 1, r[[j]]}], {j, 1, g}]
 ] ]

GNIGcdf[r_, b_, l_, a_, w_] := Module[{g, c},
  g = Length[r];
  c = Makec[r, l, g];
  a ^ b * w ^ b / Gamma[b + 1] * Hypergeometric1F1[b, b + 1, -a w] -
   Product[l[[j]] ^ r[[j]], {j, 1, g}] * a ^ b *
    Sum[Exp[-l[[j]] * w] * Sum[c[[j]][[k]] / l[[j]] ^ k * Gamma[k] *
  Sum[w ^ (b + i) * l[[j]] ^ i / Gamma[b + 1 + i] *
    Hypergeometric1F1[b, b + 1 + i, -(a - l[[j]]) w], {i, 0, k - 1}],
       {k, 1, r[[j]]}],
    {j, 1, g}]
 ]

Makec[r_, l_, p_] := Module[{c},
```

```
  c = Table[Table[1, {j, 1, Max[r]}], {i, 1, p}];
Table[c = ReplacePart[c, (Product[(l[[j]] - l[[i]]) ^ (-r[[j]]), {j, 1, i - 1}] *
        Product[(l[[j]] - l[[i]]) ^ (-r[[j]]), {j, i + 1, p}]) /
      (r[[i]] - 1) !, {i, r[[i]]}], {i, 1, p}];
Table[Table[c = ReplacePart[c, Sum[((r[[i]] - k + j - 1) ! *
           (Sum[r[[h]] / (l[[i]] - l[[h]]) ^ j, {h, 1, i - 1}] +
             Sum[r[[h]] / (l[[i]] - l[[h]]) ^ j, {h, i + 1, p}]) *
           c[[i]][[r[[i]] - (k - j)]]) / (r[[i]] - k - 1) !, {j, 1, k}] / k,
      {i, r[[i]] - k}], {k, 1, r[[i]] - 1}], {i, 1, p}];
  c
 ]
```

```
DistW[n_, p_, q_: 1, t_, opts___] :=
 Module[{d, pr1, pr2, pr3, adn, func, st, v, rj, a, xr, prd},
  Options[NEdistW] = {dist → 1, prcm → 300,
    prcpar → 200, prcf → 16, ad → 0, function → 1, stat → 1};
  d = dist /. {opts} /. Options[NEdistW];
  pr1 = prcm /. {opts} /. Options[NEdistW];
  pr2 = prcf /. {opts} /. Options[NEdistW];
  pr3 = prcpar /. {opts} /. Options[NEdistW];
  adn = ad /. {opts} /. Options[NEdistW];
  func = function /. {opts} /. Options[NEdistW];
  st = stat /. {opts} /. Options[NEdistW];
  v = IntModule[n, p, q, st, d, pr1, pr3, adn];
  rj = If[st == 1, Rj1[n, p],
    If[st == 2, Rj1[n, p - {0, 1}], If[st == 3, Rj3[n, p], Rj4[n, p, q]]]];
  g = If[st == 1, g = Total[p], If[st == 2, g = Total[p] - 1, g = p]];
  a = Table[(n - j) / n, {j, 2, g}];
  xr = Rationalize[t, 0];
  Product[a[[j]] ^ rj[[j]] * (a[[j]] - I * xr) ^ (-rj[[j]]), {j, 1, g - 1}] *
   Phi21[n, p, t]
        ]

FCE[n_, p_, t_] := Product[Product[Gamma[(n - j) / 2] *
    Gamma[(n - Sum[p[[l]], {l, k + 1, Length[p]}] - j) / 2 - n / 2 * I * t] /
     (Gamma[(n - Sum[p[[l]], {l, k + 1, Length[p]}] - j) / 2] *
       Gamma[(n - j) / 2 - n / 2 * I * t]), {j, 1, p[[k]]}], {k, 1, Length[p] - 1}]
```

```
p = {2, 4, 6, 6, 8, 11, 14};

kstar = Floor[Total[Mod[p, 2]] / 2]
```

```
0
```

```
n = 25; p = {5, 6, 9, 3}; tt = 3 / 10;
Rj1[n, p]
```

```
{0, 2, 4, 5, 6, 7, 7, 7, 7, 7, 6, 6, 5, 5, 4, 4, 3, 3, 2, 2, 1, 1}
```

```
n = 25; p = {5, 6, 9, 3}; tt = 3 / 10;
SetPrecision[DistW[n, p, 1, tt], 20]
SetPrecision[FCE[n, p, tt], 22]
```

$$-9.1127546996178610 \times 10^{-10} + 9.0980761637072760 \times 10^{-9}\, i$$

$$-9.1127546996178610 \times 10^{-10} + 9.0980761637072603 \times 10^{-9}\, i$$