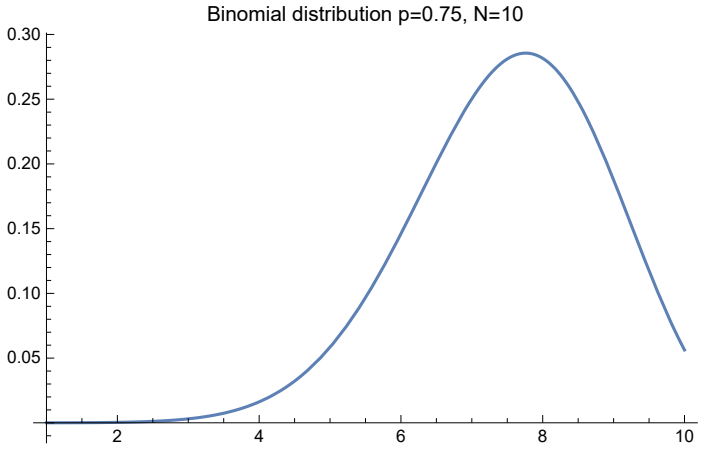
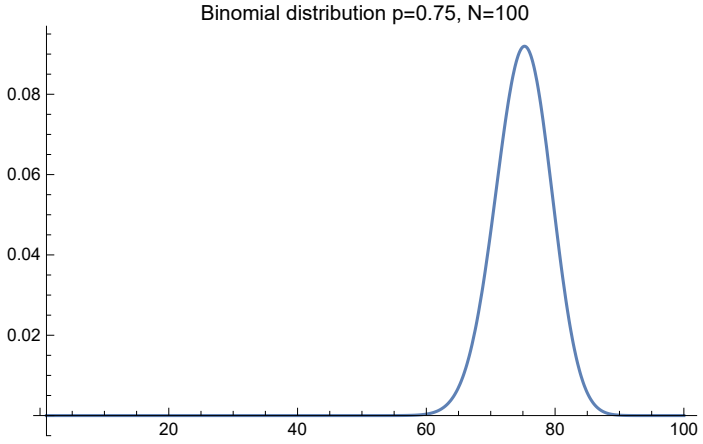
In[1]:=
```
P[N_, x_, p_] := Binomial[N, x] p^x (1 - p)^(N - x)
PlotP[N_] := Plot[P[N, x, 0.75], {x, 1, N}, PlotRange → Full,
  PlotLabel → "Binomial distribution p=0.75, N=" <> ToString[N]]
PlotP[10]
PlotP[100]

Generator[N_] := If[# > 0, 1, 0] & /@ RandomInteger[{0, 3}, N]
testGenerator10 = Total[Generator[10]]
testGenerator100 = Total[Generator[100]]
PlotHistogram[N_, Trials_] := Histogram[Table[Total[Generator[N]], {i, Trials}],
  {1}, PlotRange → {{0, N}, {0, Trials}}, PlotLabel →
   "Distribution from " <> ToString[Trials] <> " simulations of 10 p=0.75 coin flips"]
PlotHistogram[
 10,
 100]
```

Out[3]=



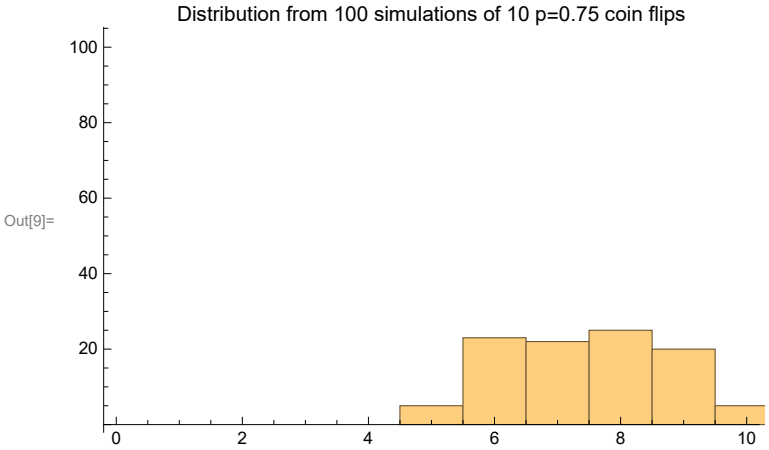
Out[4]=



Out[6]= 9

Out[7]= 76

Out[9]=



In[10]:=
```
DualLCG[nterms_] :=
 Module[{m1 = 2^31 - 85, m2 = 2^31 - 249, a1 = 40014, a2 = 40692, q0 = 1, s0 = 1, qs, ss},
  qs = NestList[Mod[a1 #1, m1] &, q0, nterms - 1];
  ss = NestList[Mod[a2 #1, m2] &, s0, nterms - 1];
  MapThread[If[#1 - #2 ≤ 0, #1 - #2 + m1 - 1, #1 - #2] / m1 &, {qs, ss}]
 ]
seeds = DualLCG[1]
(* Should contain predictable start value (a1-a2 mod m1)/m1 - usually ~1.0 *)
N[seeds]
```

Out[11]= $\left\{\frac{2\,147\,483\,562}{2\,147\,483\,563}\right\}$

Out[12]= {1.}

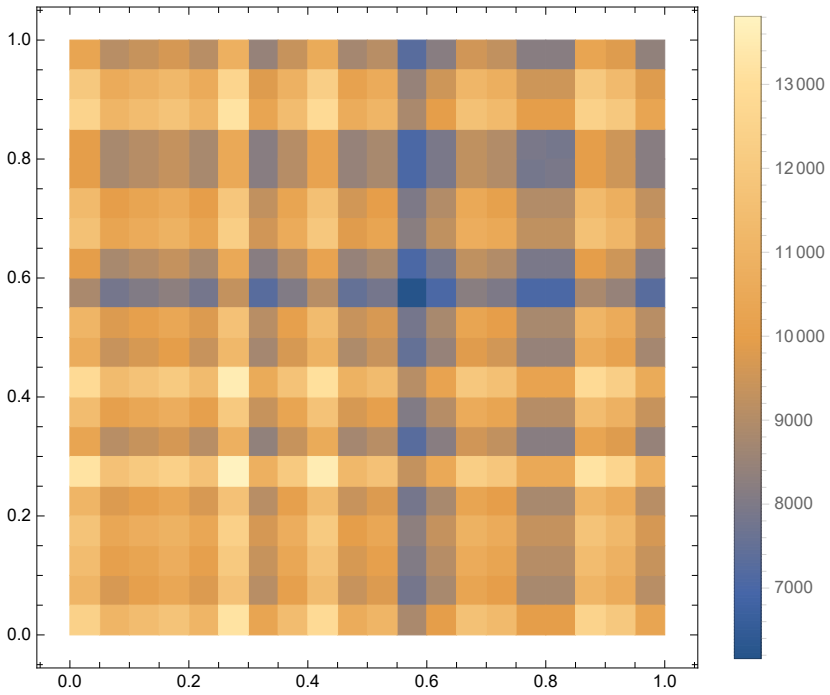
In[13]:=
```
TestRNG[frng_, nterms_] :=
 Module[{results, mresults},
  results = frng[nterms];
  mresults = N[results];
  Print["Mean = ", Mean[mresults]];
  Print["Variance = ", Variance[mresults]];
  Print["Pairwise correlation = ", Mean[Times @@ # & /@ Subsets[mresults, {2}]]];
  Print[DensityHistogram[Permutations[mresults, {2}],
    PerformanceGoal → "Speed", ChartLegends → Automatic]];
 ]
Print["Testing Dual LC"];
TestRNG[DualLCG, 2000]
```

```
Testing Dual LC

Mean = 0.492077

Variance = 0.0852173

Pairwise correlation = 0.242097
```



I do notice some anti-bunching up at around 0.5 which makes me think that I haven't managed to get this perfectly cyclical but it seems to work. Mathematica's default generator seem to show some moire patterns as well - so I guess we're ok.

In[16]:=
```
Print["Testing Mathematica default uniform RNG"];
TestRNG[RandomReal[{0, 1}, #1] &, 2000]
```

```
Testing Mathematica default uniform RNG
Mean = 0.50337
Variance = 0.0856065
Pairwise correlation = 0.253338
```