Clear all symbols from previous evaluations to avoid problems

```
Clear["Global`*"]
```

Clusters on a one-dimensional lattice

Count cluster sizes on a one-dimensional lattice and save *cluster numbers* (probability, normalized per site, of finding a cluster of a ceratin size in a lattice) into the array *clusters*

In[1]:=
```
n = 1000; (* lattice size *)
np = 100; (* number of probabilities *)
nconf = 500; (* number of configurations generated for each probability *)
probs = N[Range[np] / np];
ns = ConstantArray[0.0, {np, n}];
Do[ (* loop over probabilities *)
  Do[ (* loop over configurations *)
   lattice = Array[If[RandomReal[] ≤ probs[[ip]], 1, 0] &, n];
   s = 0;
   Do[ (* loop over lattice *)
    If[lattice[[i]] == 1,
     s++,
     If[s > 0,
      ns[[ip, s]]++;
      s = 0
     ]
    ],
    {i, 1, n}
   ];
   If[s > 0, ns[[ip, s]]++],
   {ic, 1, nconf}
  ],
  {ip, 1, np}
 ];
ns = ns / nconf / n;
```

Check that approximately

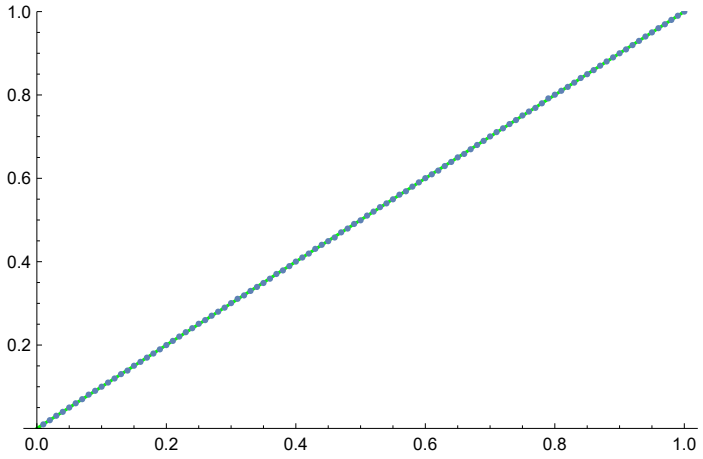
$$M_1(p) = \sum_s n_s(p)\, s = p$$

and that the average cluster size at a randomly chosen site

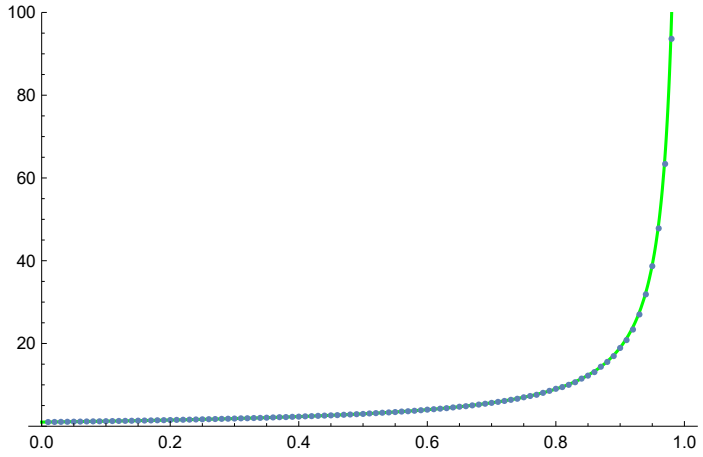
$$S = \frac{M_2(p)}{M_1(p)} = \frac{1+p}{1-p} \quad \text{where} \quad M_2(p) = \sum_s n_s(p)\, s^2$$

In[8]:=
```
moment1 = ConstantArray[0.0, np];
moment2 = ConstantArray[0.0, np];
S = ConstantArray[0.0, np];
Do[ (* loop over probabilities *)
  Do[ (* loop over configurations *)
   moment1[[ip]] += ns[[ip, s]] * s;
   moment2[[ip]] += ns[[ip, s]] * s^2,
   {s, 1, n}
  ];
  S[[ip]] = moment2[[ip]] / moment1[[ip]],
  {ip, 1, np}
 ];
Show[{Plot[p, {p, 0, 1}, PlotRange → {0, 1}, PlotStyle → Green],
  ListPlot[Transpose[{probs, moment1}]]}]
Show[{Plot[(1 + p) / (1 - p), {p, 0, 1}, PlotRange → {0, 100}, PlotStyle → Green],
  ListPlot[Transpose[{probs, S}]]}]
```

Out[12]=



Out[13]=



Comparison of cluster numbers with theoretical prediction

In[19]:=
```
fns[p_, s_] := p^s (1 - p)^2;
smin = 1; smax = 5;
pexact =
  Plot[Table[fns[p, s], {s, smin, smax}], {p, 0, 1}, PlotRange → All, PlotStyle → Green];
pMC = ListPlot[Table[Transpose[{probs, ns[[All, s]]}], {s, smin, smax}],
   PlotRange → All, PlotStyle → PointSize[0.01]];
Show[pexact, pMC]
```

Out[23]=