

Complex networks

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Export directory

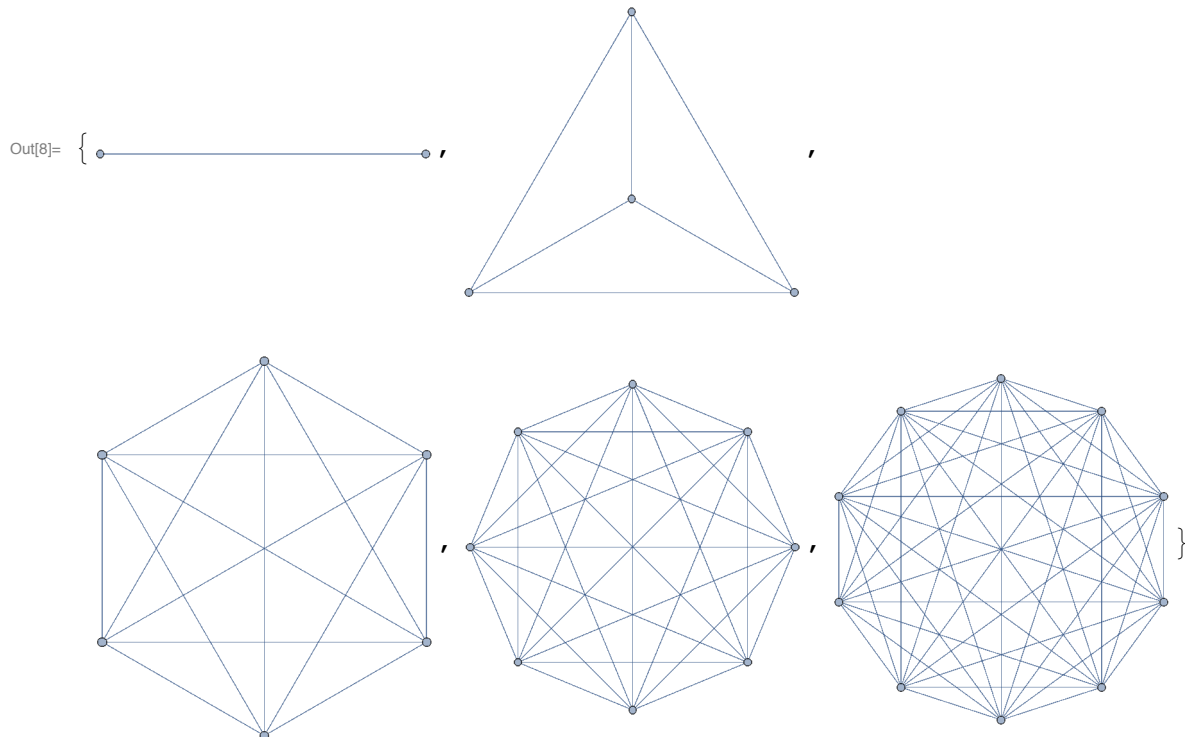
```
In[2]:= SetDirectory["~/archive/cours/outreach/networks/mathematica"]
```

```
Out[2]:= /Users/ht/archive/cours/outreach/networks/mathematica
```

Regular graphs

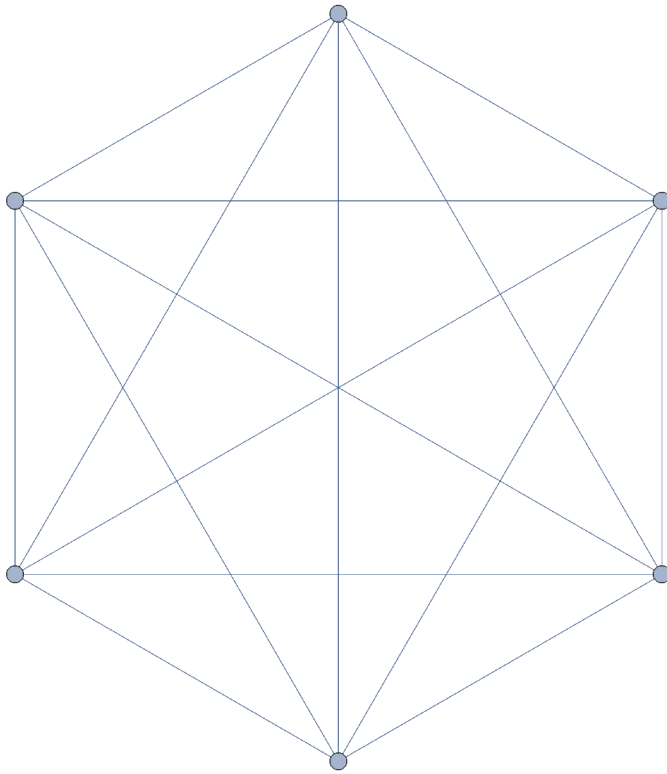
Complete graphs

```
In[8]:= Table[CompleteGraph[i], {i, 2, 10, 2}]
```

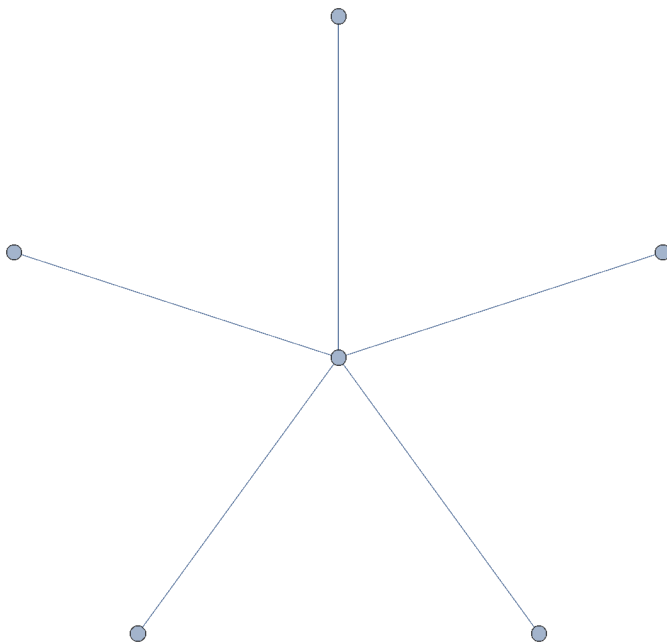


Other regular graphs

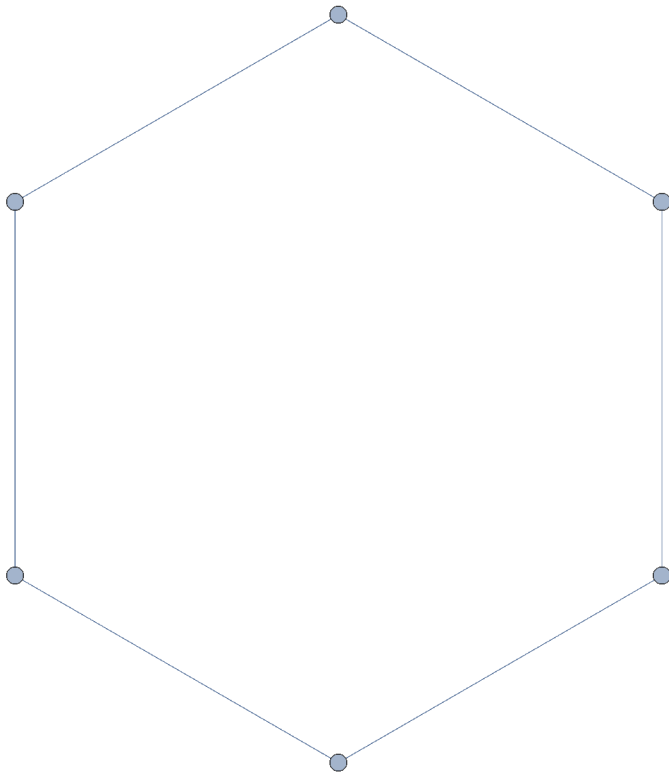
CompleteGraph[6]



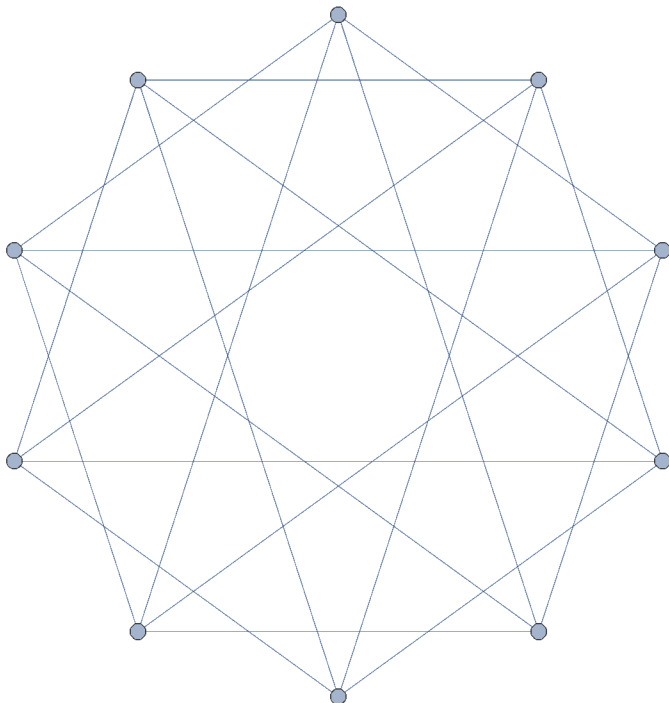
StarGraph[6]



CycleGraph[6]



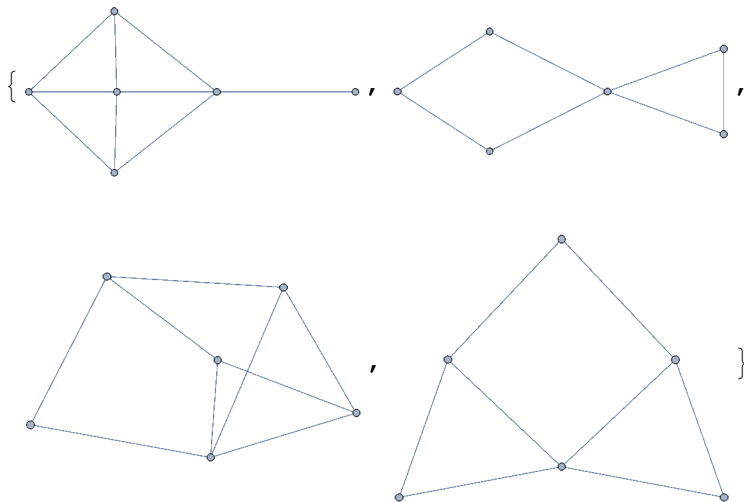
CirculantGraph[10, {2, 4}]



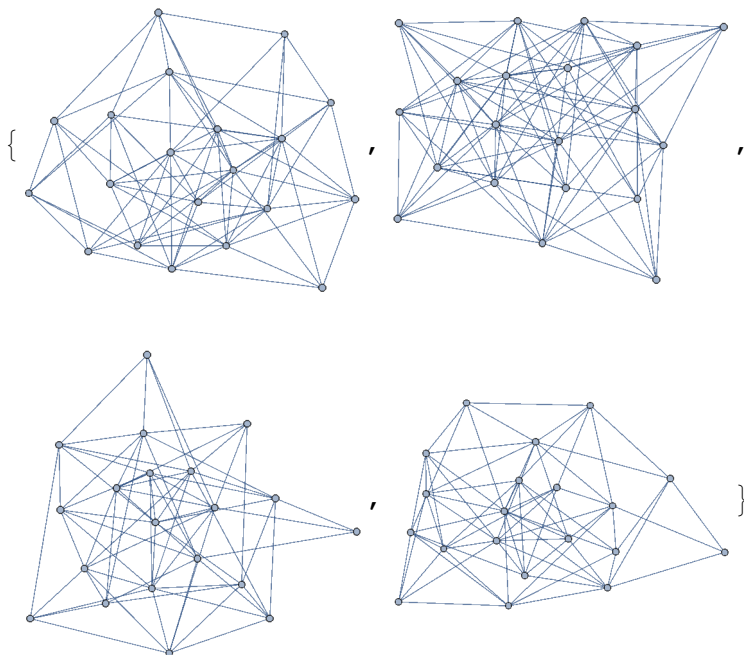
Random graphs

Examples

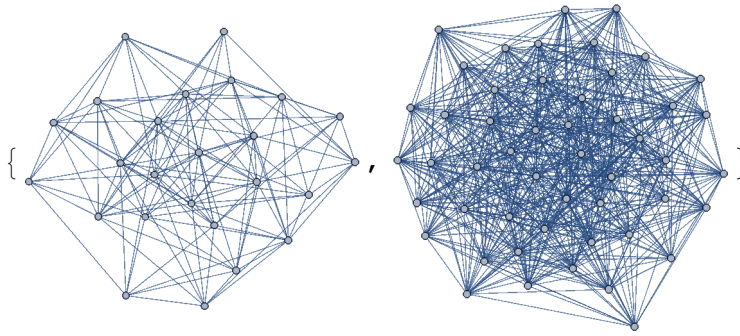
```
Table[RandomGraph[BernoulliGraphDistribution[6, 0.5]], {4}]
```



```
Table[RandomGraph[BernoulliGraphDistribution[20, 0.4]], {4}]
```

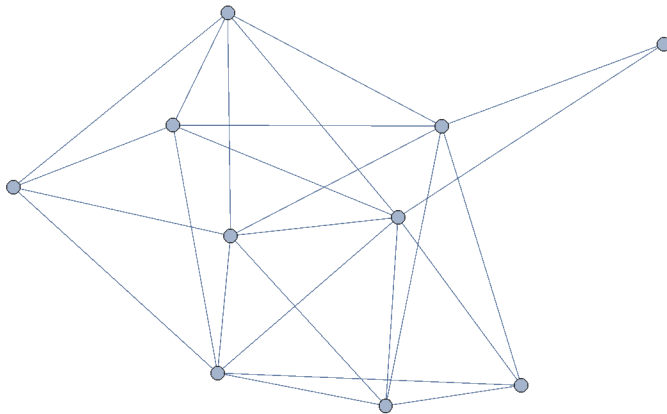


```
Table[RandomGraph[BernoulliGraphDistribution[n, 0.5]], {n, {25, 50}}]
```



Degree distribution

```
g1 = RandomGraph[BernoulliGraphDistribution[10, 0.5]]
```



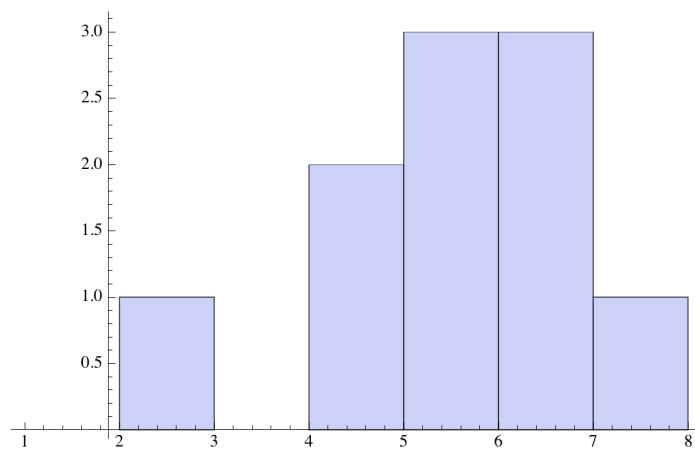
```
VertexDegree[g1]
```

```
{2, 5, 5, 4, 4, 6, 6, 7, 6, 5}
```

```
EdgeCount[g1]
```

```
25
```

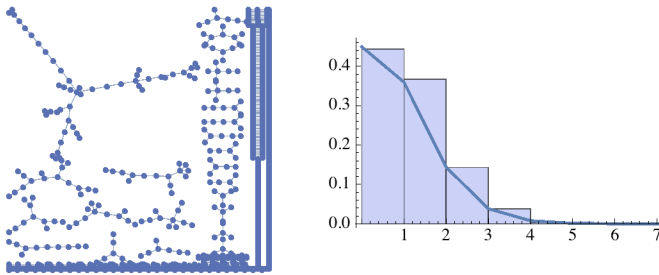
```
pf1 = Histogram[VertexDegree[g1], {1}, PlotTheme -> "Classic"]
```



```
Export["randomgraph0degdist.pdf", pf1]
randomgraph0degdist.pdf
```

Poisson distribution

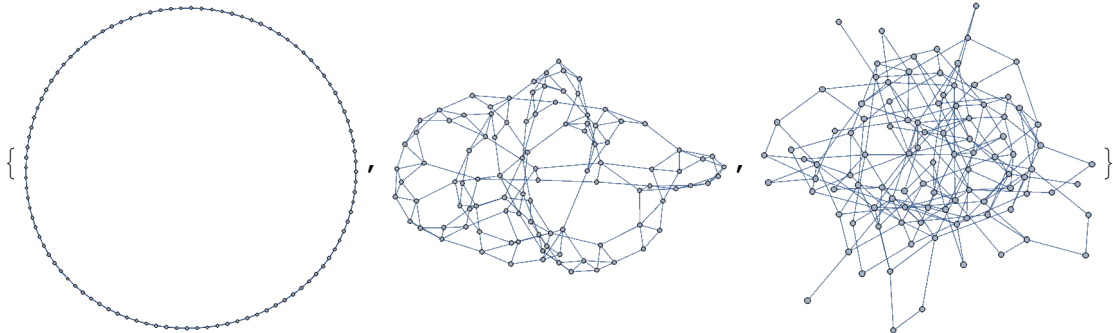
```
pf2 = With[{nvert = 1000},
  p = 0.8 / nvert;
  g = RandomGraph[BernoulliGraphDistribution[nvert, p]];
  degseq = VertexDegree[g];
  p1 = Histogram[degseq, Automatic, "Probability", PlotTheme -> "Classic"];
  p2 = DiscretePlot[PDF[PoissonDistribution[nvert p], x],
    {x, 0, 10}, Joined -> True, Filling -> None];
  GraphicsRow[{Show[g], Show[p1, p2]}]
]
```



```
Export["randomgraphdist2.pdf", pf2]
```

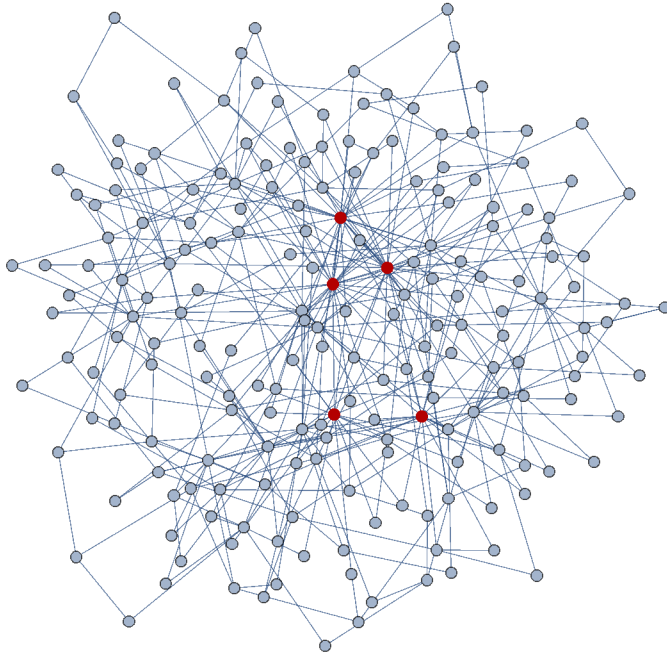
Small world graphs

```
Table[RandomGraph[WattsStrogatzGraphDistribution[100, p, 2]], {p, {0, 0.1, 1}}]
```

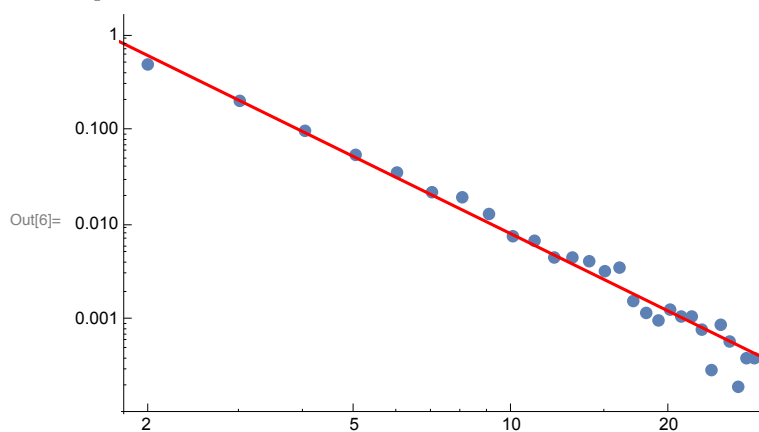


Scale-free graphs

```
gsf1 = With[{},
  g = RandomGraph[BarabasiAlbertGraphDistribution[200, 2]];
  sg = Part[VertexList[g], Ordering[VertexDegree[g], -5]];
  HighlightGraph[g, sg]
]
```



```
In[6]:= pf3 = With[{nvert = 10^4},
  g = RandomGraph[BarabasiAlbertGraphDistribution[nvert, 2]];
  dist = EmpiricalDistribution[VertexDegree[g]];
  p1 = ListLogLogPlot[Table[{k, PDF[dist, k]}, {k, 1, 30}]];
  p2 = LogLogPlot[4/k^2.7, {k, 1, 30}, PlotStyle -> {Red}];
  Show[p1, p2]
]
```



```
In[7]:= Export["scalefreedist1.pdf", pf3]
```

Out[7]= scalefreedist1.pdf

Centrality

From the *Mathematica* document center.

```
g = ExampleData[{"NetworkGraph", "ZacharyKarateClub"}];
```

```
Part[VertexList[g], Ordering[BetweennessCentrality[g], -5]]
```

```
{32, 3, 33, 34, 1}
```

```
HighlightGraph[g, %]
```

