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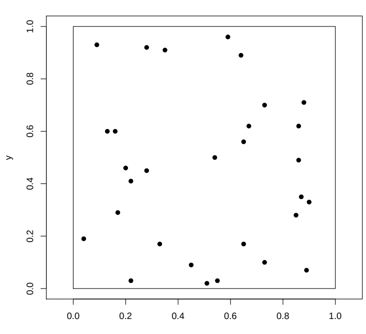
Department of Statistics

Statistics C173/C273 **Instructor: Nicolas Christou**

Plot ecdf against cdf for point patten data

Consider the following coordinates of 30 events distributed over the unit square as shown on the graph below.

```
        x    y
 [1,] 0.54 0.50
 [2,] 0.67 0.62
 [3,] 0.64 0.89
 [4,] 0.45 0.09
 [5,] 0.90 0.33
 [6,] 0.51 0.02
 [7,] 0.04 0.19
 [8,] 0.87 0.35
 [9,] 0.89 0.07
[10,] 0.85 0.28
[11,] 0.17 0.29
[12,] 0.35 0.91
[13,] 0.13 0.60
[14,] 0.86 0.49
[15,] 0.73 0.10
[16,] 0.28 0.92
[17,] 0.88 0.71
[18,] 0.73 0.70
[19,] 0.20 0.46
[20,] 0.33 0.17
[21,] 0.65 0.56
[22,] 0.59 0.96
[23,] 0.09 0.93
[24,] 0.65 0.17
[25,] 0.22 0.41
[26,] 0.16 0.60
[27,] 0.55 0.03
[28,] 0.28 0.45
[29,] 0.22 0.03
[30,] 0.86 0.62
```



The nearest neighbor distances (NND) are the following:

```
 [1] 0.125 0.063 0.086 0.092 0.036 0.041 0.164 0.036
 [9] 0.163 0.071 0.130 0.071 0.030 0.130 0.106 0.071
[17] 0.092 0.100 0.054 0.144 0.063 0.086 0.190 0.106
[25] 0.054 0.030 0.041 0.072 0.178 0.092
```

Now generate a vector of distances r that will help us construct the empirical cumulative distribution function (ecdf) and the theoretical cumulative distribution function (cdf). The range of the NND values is (0.03, 0.19), so let's use the following $r = (0.04, 0.06, 0.08, 0.10, 0.12, 0.14, 0.16, 0.18, 0.20)'$. The following table gives `ecdf` and `cdf`. Note: Assume that the random process has $\lambda = 30$.

r	Number of $NND \leq r$	ecdf: $\hat{G}(r) = \frac{col2}{30}$	cdf: $G_0(r) = 1 - e^{-\lambda \pi r^2}$
0.04	4	$\frac{4}{30} = 0.133$	$1 - exp(-\lambda\pi 0.04^2) = 0.140$
0.06	8	$\frac{8}{30} = 0.267$	$1 - exp(-\lambda\pi 0.06^2) = 0.288$
0.08	14	$\frac{14}{30} = 0.467$	$1 - exp(-\lambda\pi 0.08^2) = 0.453$
0.10	20	$\frac{20}{30} = 0.667$	$1 - exp(-\lambda\pi 0.10^2) = 0.610$
0.12	22	$\frac{22}{30} = 0.733$	$1 - exp(-\lambda\pi 0.12^2) = 0.743$
0.14	25	$\frac{25}{30} = 0.833$	$1 - exp(-\lambda\pi 0.14^2) = 0.842$
0.16	26	$\frac{26}{30} = 0.867$	$1 - exp(-\lambda\pi 0.16^2) = 0.910$
0.18	29	$\frac{29}{30} = 0.967$	$1 - exp(-\lambda\pi 0.18^2) = 0.953$
0.20	30	$\frac{30}{30} = 1.000$	$1 - exp(-\lambda\pi 0.20^2) = 0.977$

Finally we plot $\hat{G}(r)$ against $G_0(r)$ to get the following plot: