

Proportional Sampling \rightarrow prob. sampling

$$d = \begin{array}{c|c|c|c|c|c} d_1 & d_2 & d_3 & d_4 & \dots & d_n \\ \hline 2.0 & 6.0 & 12 & 5.8 & \dots & 200 \\ \hline 1 & 2 & 3 & 4 & \dots & n \end{array}$$

Let, $n = 5$

Task:- Pick an element amongst the n -elements such that the prob. of picking an element is proportional to values (d_i 's)

randomly pick \rightarrow each are equiprobable (do not want that)

\rightarrow prob. of picking ele $d_3 \rightarrow$ must be smallest

step 1 (a) $S = \sum_{i=1}^n d_i = 35$ (compute the sum)

(b) $d_i' = d_i / S \rightarrow d_1', d_2', d_3' \dots d_5' \rightarrow$ Normalizing using the sum.

d_1'	d_2'	d_3'	d_5'
\downarrow	\downarrow	\downarrow	\downarrow
0.0571	0.171428	0.0343	0.5714

0 to 1

sum of all = $\sum d_i' = \sum \frac{d_i}{S} = 1$

(c) Cumulative normalization sum

$d_1' = 0.0571$	$\tilde{d}_1 = d_1' = 0.0571$
$d_2' = 0.171428$	$\tilde{d}_2 = d_1' + d_2' = 0.228528$
$d_3' = \dots$	$\tilde{d}_3 = d_1' + d_2' + d_3' = 0.262828$
$d_4' = \dots$	\vdots
$d_5' = 0.5714$	$\tilde{d}_5 = d_1' + d_2' + \dots + d_5' = 1$

\tilde{d}_i = Cumulative-normalized-value

Step 2:-

Sample one value $\text{unif.}(0.0, 1.0)$

x = $\text{numpy.random.uniform}(0.0, 1.0, 1)$ How many no. you want

Let, $x = 0.6$

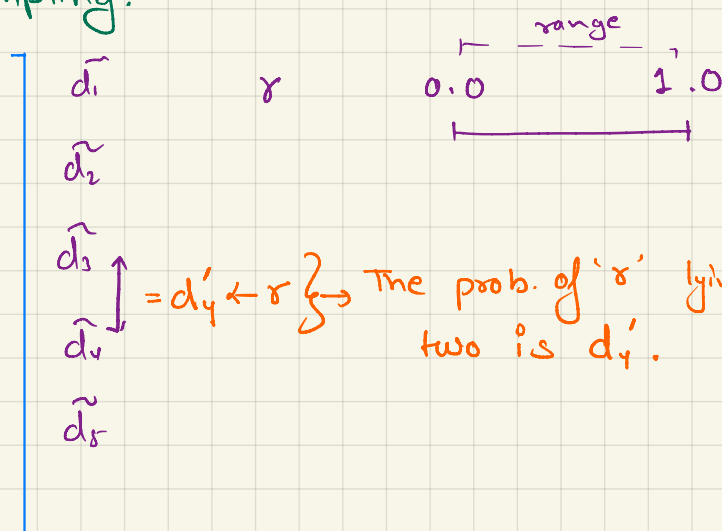
Step 3:- proportional - sampling.

if $x \leq \tilde{d}_1$
return 1

elif $x \leq \tilde{d}_2$
return 2

⋮

else



$= d'_4 \leftarrow x \rightarrow$ The prob. of ' x ' lying b/w these two is d'_4 .

prob. of picking up 'y'

The prob. of x lying b/w \tilde{d}_3 & $\tilde{d}_4 = d'_4 \propto d_4$ [$d'_4 = \frac{d_4}{S}$]