



Faculty Of Computers and Artificial Intelligence

Cairo University

212202.FCI.AI496.Selected Topics in Artificial intelligence-2

Assignment (1)

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Submitted to

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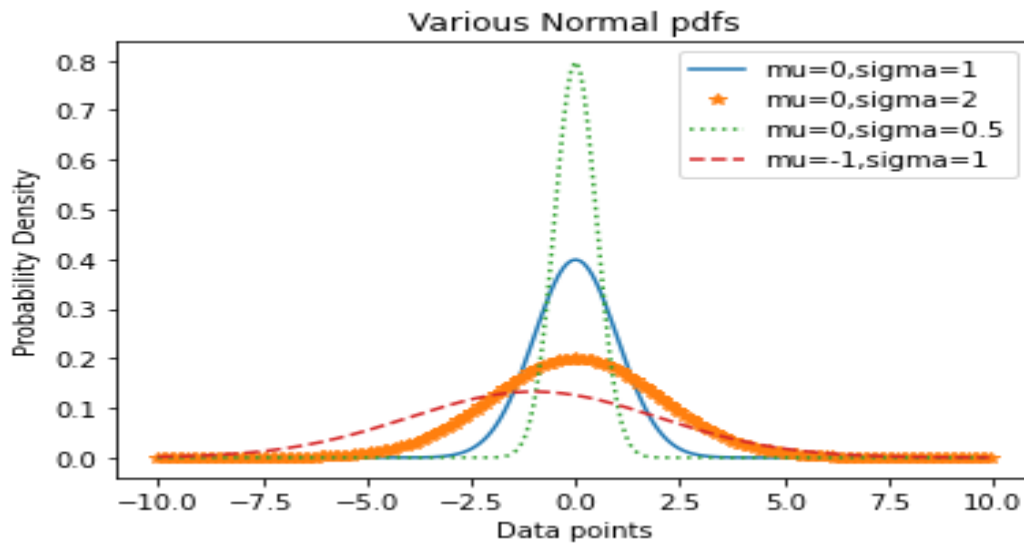
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Probabibility Density Function

1-Normal distribution

$$f(x; \mu, \sigma) = \frac{1}{\sqrt{2\pi \cdot \sigma^2}} \cdot e^{-\frac{1}{2} \cdot \left(\frac{x-\mu}{\sigma}\right)^2}$$



```
output=normal_pdf(.5, .mu=0.0, .sigma=1.0)
```

```
output=0.3520653267642995
```

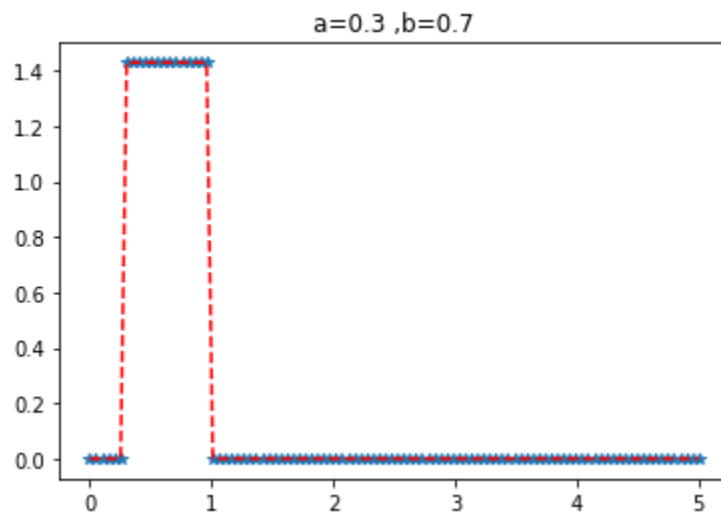
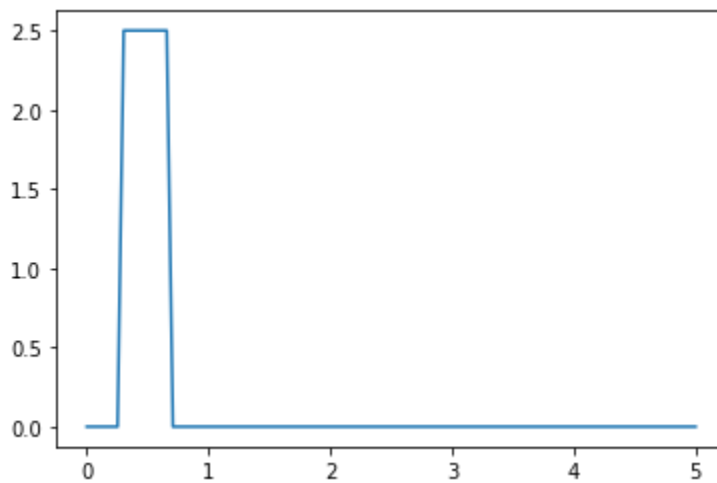
2-Uniform distribution

$$p(x) = \begin{cases} \frac{1}{b-a} & x \in [a, b], \\ 0 & x \notin [a, b]. \end{cases}$$

TASK

a=5.5 b=10

```
uniform_pdf(8, 5.5, 10)=0.2222222222222222
```



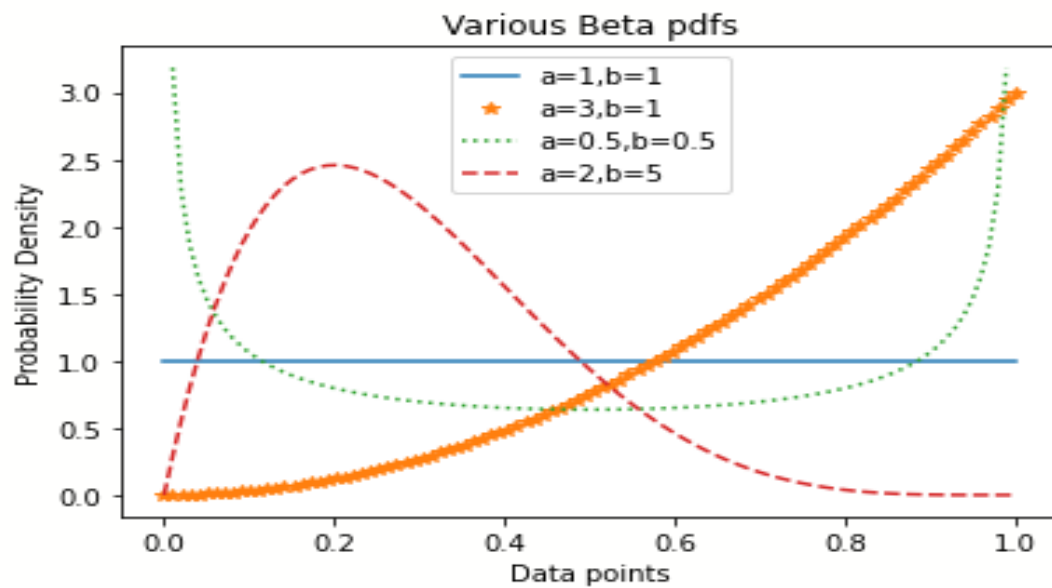
3-Beta distribution

$$P(x; \alpha, \beta) = (const) * x^{\alpha-1} * (1-x)^{\beta-1}$$

$$const = \Gamma(\alpha + \beta) / [\Gamma(\alpha) * \Gamma(\beta)]$$

```
output=beta_pdf(.2,2,5)
```

```
output=2.4576000000000007
```



4-Binomial distribution

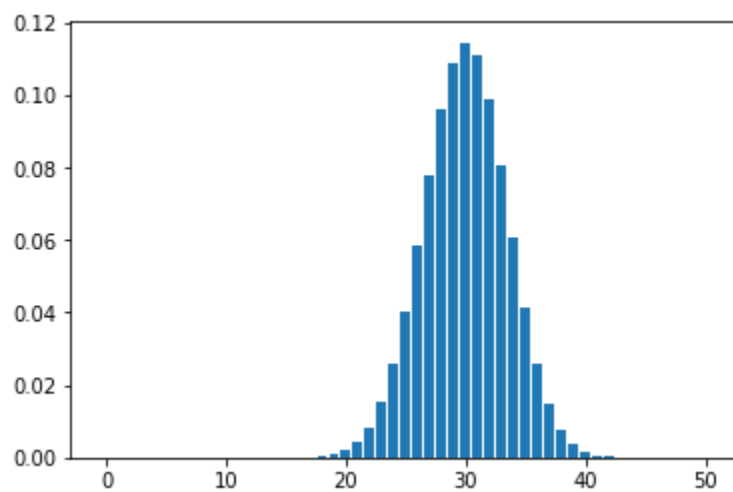
$$P(r; N, p) = \left(\frac{N!}{r!(N-r)!} \right) p^r (1-p)^{N-r}$$

mean= Np , variance= $Np(1-p)$

Binomial($r=15, n=30, p=0.6$)

```
output =binomial(15,30,.6)
```

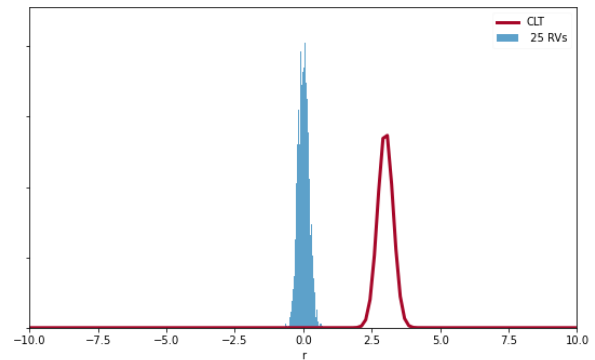
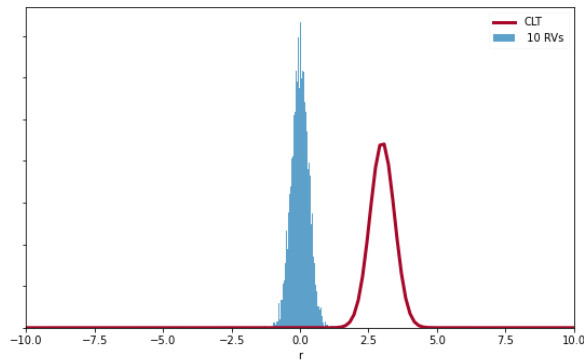
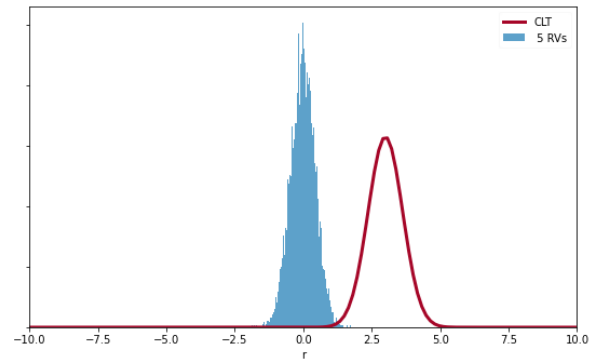
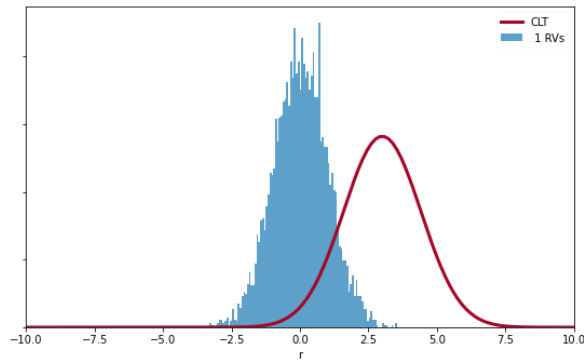
```
output =0.07831220968608016
```



Central Limit Theorem

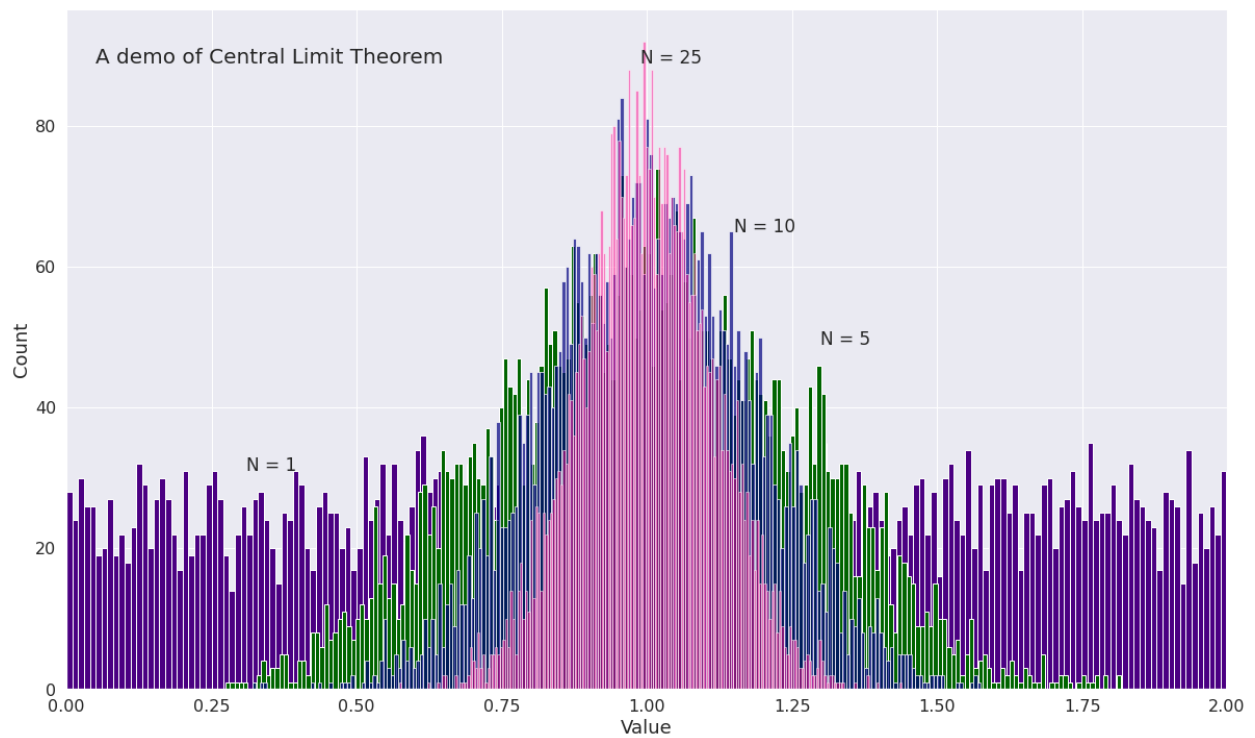
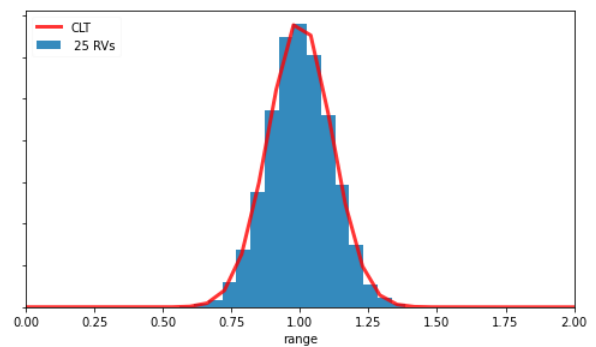
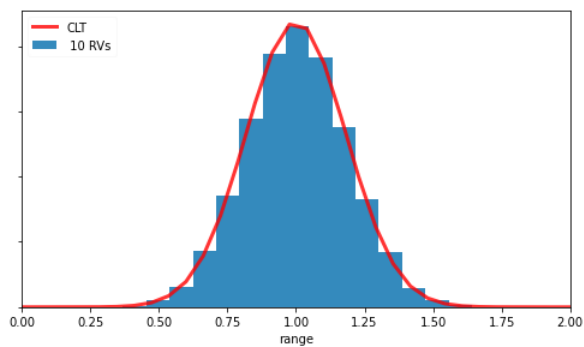
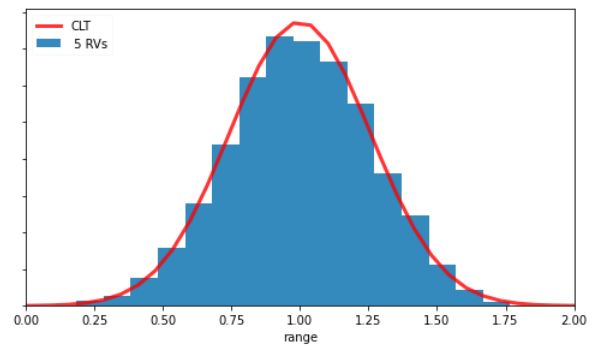
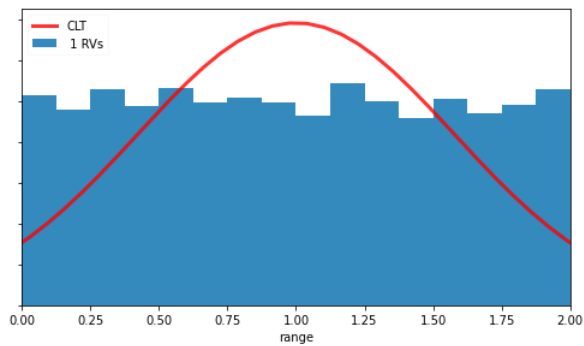
1- Normal ($m = 3$, $\text{var} = 2$)

Addition of independent Gaussian distributions is a Gaussian distribution



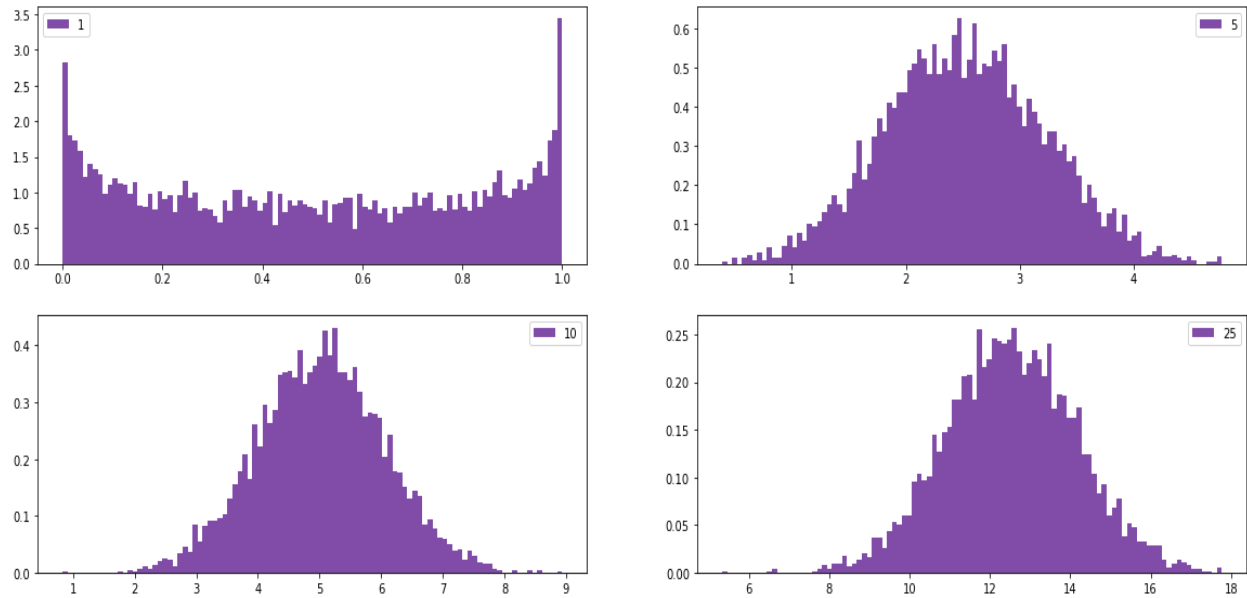
2- Uniform(0 to 2)

Addition of uniform random variables (RVs) converge to a Gaussian distribution (CLT)



3- Beta on $a,b = (0.7,0.7)$

Beta Distribution with $n=1, n=5, n=10, n=25$, $N=5000$



4- Beta on $a,b = (3,1)$

Beta Distribution with $n=1, n=5, n=10, n=25$, $N=5000$

