April 05, 2018

CK0030: Partial evaluation I

Exercise 01 (60%). The binomial theorem expands any n-power of $a+b$ ($a, b \in \mathcal{R}$) into a sum

$$
\begin{aligned}
(a+b)^n &= \sum_{k=0}^{n} \frac{n!}{k!(n-k)!} a^k b^{n-k}, \quad n \in \{0, 1, 2, \dots\} \\
&= \underbrace{\frac{n!}{0!(n-0)!} a^0 b^{n-0}}_{k=0} + \underbrace{\frac{n!}{1!(n-1)!} a^1 b^{n-1}}_{k=1} + \cdots + \underbrace{\frac{n!}{n!(n-n)!} a^n b^{n-n}}_{k=n}
\end{aligned}
$$

Write code to calculate the polynomial $(a+b)^n$ for $a=-3$, $b=5$ and $n=4$. [*Note:* $0! = 1$]

Solution:

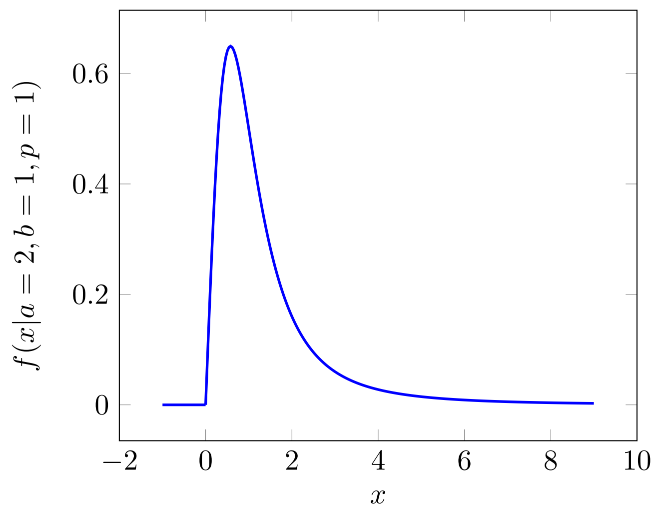
```python
from math import factorial

a = -3.0
b = +5.0
n = 4

k=0
zum = 0.0

while k <= n:
 term1 = factorial(n)/(factorial(k)*factorial(n-k))
 term2 = (a**k)*b**(n-k)

 zum = zum + term1*term2
 k = k + 1
```

Exercise 02 (40%). The probability density function of the Dagum distribution is given by

$$f(x|a,b,p) = \frac{ap}{x} \frac{(x/b)^{ap}}{[(x/b)^a + 1]^{p+1}}$$

x is the independent variable, $a > 0$, $b > 0$ and $p > 0$ are parameters.

Write code to calculate $f(x|a = 2, b = 1, p = 1)$ at $x = 0.8$.



Solution:

```
a = 2.0
b = 5.0
p = 1.0

x = 0.8

term1  = a*p/x
term2a = (x/b)**(a*p)
term2b = ((x/b)**a + 1)**(p+1)

f = term1*term2a/term2b
```