Jun 27, 2019

CK0030: Partial evaluation III (bis)

Exercise 01. The following Python code wrongly implements the following functions

$$\begin{cases} \mathcal{L}(x_1,x_2,x_3,x_4) = \prod_{i=1}^{|\mathcal{X}|} \underbrace{\frac{1}{x_i\sigma\sqrt{2\pi}}\exp\left\{\frac{-\left[\ln(x_i)-\mu\right]^2}{2\sigma^2}\right\}}_{l_i} \\ \mathcal{P}(x_1,x_2,x_3,x_4|K_e,K_l) = \prod_{i=1}^{|\mathcal{X}|} \underbrace{\frac{1}{x_i\sigma\sqrt{2\pi}}\sum_{k_e=1}^{K_e}\left\{\frac{\left\{\frac{-\left[\sum_{k_l=1}^{K_l}\frac{(-1)^{k_l-1}(x_i-1)^{k_l}}{k_l}-\mu\right]^2}{2\sigma^2}\right\}^{k_e}}{k_e!}\right\}}_{p_i} \end{cases},$$

for $\mathcal{X} = \{x_i\}_{i=1}^{|\mathcal{X}|=4} = \{0.8840, 1.2055, 0.9321, 1.0255\}$, $K_e = 32$, $K_l = 32$, $\mu = 0$ and $\sigma = 0.25$.

Find the errors in the code and suggest possible corrections.

```
def a_logn(x,Kl):
    s = 0; k = 1
    while k <= Kl:
        t = (-1)**k * (x-1)**k / k
        s += t; k += 1; a_logn = s
    return a_logn

def a_exp(x,Ke):
    s = 0; k = 0
    while k <= Ke:
        t = x**k / factorial(k)
        s += t; k += 1; a_exp = s
    return a_exp

def a_lognorm(x,mu,sigma,Ke,Kl):
    a_p = 1/x_i/sigma/sqrt(2*pi)*a_exp(-(a_logn(x_i,Kl)-mu)**2/2/sigma**2,Ke)
    a_lognorm = a_p
    return a_log_norm

def lognorm(x,mu,sigma):
    p = 1/x_i/sigma/sqrt(2*pi)*exp(-(log(x_i)-mu)**2/2/sigma**2)
    lognorm = p
    return lognorm

from math import pi, exp, log, sqrt, factorial

X = [0.8840,1.2055,0.9321,1.0255]
mu = 0; sigma = 0.25

Ke = 32; Kl = 32; L = 0; P = 1
for x in X:
    l_i = a_lognorm(x,mu,sigma,Ke,Kl)
    p_i = lognorm(x,mu,sigma)
    L *= L_i
    P *= P_i
```

O seguinte código Python implementa erroneamente as seguintes funções

$$\begin{cases} \mathcal{L}(x_1,x_2,x_3,x_4) = \prod_{i=1}^{|\mathcal{X}|} \underbrace{\frac{1}{x_i\sigma\sqrt{2\pi}} \exp\left\{\frac{-\left[\ln(x_i)-\mu\right]^2}{2\sigma^2}\right\}}_{l_i} \\ \mathcal{P}(x_1,x_2,x_3,x_4|K_e,K_l) = \prod_{i=1}^{|\mathcal{X}|} \underbrace{\frac{1}{x_i\sigma\sqrt{2\pi}} \sum_{k_e=1}^{K_e} \left\{\frac{\left\{\frac{-\left[\sum_{k_l=1}^{K_l}\frac{(-1)^{k_l-1}(x_i-1)^{k_l}}{k_l}-\mu\right]^2}{2\sigma^2}\right\}^{k_e}}{k_e!}\right\}}_{p_i} \end{cases},$$

com $\mathcal{X} = \{x_i\}_{i=1}^{|\mathcal{X}|=4} = \{0.8840, 1.2055, 0.9321, 1.0255\}$, $K_e = 32$, $K_l = 32$, $\mu = 0$ e $\sigma = 0.25$.

Encontre os erros e sugere possíveis correções.

```
def a_logn(x,Kl):
    s = 0; k = 1
    while k <= Kl:
        t = (-1)**k * (x-1)**k / k
        s += t; k += 1; a_logn = s
    return a_logn

def a_exp(x,Ke):
    s = 0; k = 0
    while k <= Ke:
        t = x**k / factorial(k)
        s += t; k += 1; a_exp = s
    return a_exp

def a_lognorm(x,mu,sigma,Ke,Kl):
    a_p = 1/x_i/sigma/sqrt(2*pi)*a_exp(-(a_logn(x_i,Kl)-mu)**2/2/sigma**2,Ke)
    a_lognorm = a_p
    return a_log_norm

def lognorm(x,mu,sigma):
    p = 1/x_i/sigma/sqrt(2*pi)*exp(-(log(x_i)-mu)**2/2/sigma**2)
    lognorm = p
    return lognorm

from math import pi, exp, log, sqrt, factorial

X = [0.8840,1.2055,0.9321,1.0255]
mu = 0; sigma = 0.25

Ke = 32; Kl = 32; L = 0; P = 1
for x in X:
    l_i = a_lognorm(x,mu,sigma,Ke,Kl)
    p_i = lognorm(x,mu,sigma)
    L *= L_i
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```