Cover page for answers.pdf

CSE 512 Fall 2019 – Machine Learning – Homework 1

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E(X):

Here, we know that the X, X = max (X_1, X_2). This makes the fn.

So, it will be

$$L = P(x_1 < x)\, P(x_2 < x)$$

$$= x \cdot x$$

$$= x^2$$

This is the cdf, now pdf is

$$\frac{\partial L}{\partial x} = 2x \cdot = \text{pdf}$$

Now, for getting the E(X)

$$E(x) = \int_a^b x\, p(x)\, dx$$

$$= \int_0^1 x \cdot 2x\, dx$$

$$= \left[\frac{2x^3}{3}\right]_0^1$$

$$= \frac{2}{3}$$

Var(X)

Now, we have $E(X) = \frac{2}{3}$.

for, $E(X^2)$, we do,

$$E(X^2) = \int_0^1 x^2 \cdot 2x\,dx$$

$$= \left[\frac{2x^4}{4}\right]_0^1 = \left[\frac{1}{2}x^4\right]_0^1$$

$$= \frac{1}{2}.$$

Now, $Var(X) = E(X^2) - (E(X))^2$

$$= \frac{1}{2} - \left(\frac{2}{3}\right)^2$$

$$= \frac{1}{2} - \frac{4}{9}$$

$$= 1/18$$ ∎

Here, we have to find

$cov(X, X_1)$.

Now, the X here as we know before can either take X_1 or X_2.

So, $cov(X, X_1) \Rightarrow cov(X_1, X_1) \cdot cov(X_2, X_1)$

Here, $cov(X_2, X_1) = 0$ as they are independent.

Now, $cov(X_1, X_1) = var(X_1)$

which is nothing but

$$E(X_1^2) - \mu^2$$

$$\Rightarrow \left(\frac{1}{3}\right) - \left(\frac{1}{2}\right)^2$$

$$= \frac{1}{3} - \frac{1}{4}$$

$$= \frac{1}{12}$$ Ans

Question 2.1

When N=10

```
import random
import math

p=0
q=0
t=0
l3 = []

def question2(res):
    global p
    global t
    l1 = res.keys()
    l2 = res.values()
    q = 0
    d = 0
    l3 = []
    for x, y in zip(l1, l2):
        l3.append(max(x, y))
        d = 0
    for x in l3[:]:
        d = d + x
    d = d / 10
    p =p+d
    q = 0
    for x in l3[:]:
        q = q + ((x - d) ** 2)
        q=math.sqrt(q)
    q = q / 10
    t += q



for x in range(0,30):
    l1 = [random.uniform(0,1) for i in range(10)]
    l2 = [random.uniform(0,1) for i in range(10)]
    res = dict(zip(l1, l2))
    question2(res)

p = p / 30
print("E(X) is :-", p)
t = t / 30
print("SD(X) is:-", (t))
```

Question 2.2

When N=100

```
import random
import math

p=0
q=0
t=0
l3 = []

def question2(res):
    global p
    global t
    l1 = res.keys()
    l2 = res.values()
    q = 0
    d = 0
    l3 = []
    for x, y in zip(l1, l2):
        l3.append(max(x, y))
        d = 0
    for x in l3[:]:
        d = d + x
    d = d / 10
    p =p+d
    q = 0
    for x in l3[:]:
        q = q + ((x - d) ** 2)
        q=math.sqrt(q)
    q = q / 10
    t += q



for x in range(0,30):
    l1 = [random.uniform(0,1) for i in range(100)]
    l2 = [random.uniform(0,1) for i in range(100)]
    res = dict(zip(l1, l2))
    question2(res)

p = p / 300
print("E(X) is :-", p)
t = t / 300
print("SD(X) is:-", (t))
```