Assign9

Cesar Espitia

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Question 1

The price of one share of stock in the Pilsdorff Beer Company (see Exercise 8.2.12) is given by Yn on the nth day of the year. Finn observes that the differences Xn = Yn+1 − Yn appear to be independent random variables with a common distribution having mean μ = 0 and variance sigma^2 = 1/4. If Y1 = 100, estimate the probability that Y365 is (a) > 100. (b) > 110. (c) > 120.

Answer

Using CLT we can assume that the Y365-Y1 is normally distributed. We know that E[Y365-Y1]=0 and that the var(Y365-Y1) = 364*1/4.

STD = sqrt(365*.25) = 9.55

a. P{Y365-Y1 > 0} = P(Y365 > 0 / 9.55) since mu = 0 and the E=0 then probability = 0.5

```
pnorm(0, mean = 0, sd = sqrt(365*.25), lower.tail = FALSE)
```

```
## [1] 0.5
```

b. P{Y365-Y1 > 10} = P(Y365 > 10 / 9.55)

```
pnorm(10, mean = 0, sd = sqrt(365*.25), lower.tail = FALSE)
```

```
## [1] 0.1475849
```

c. P{Y365-Y1 > 20} = P(Y365 > 20 / 9.55)

```
pnorm(20, mean = 0, sd = sqrt(365*.25), lower.tail = FALSE)
```

```
## [1] 0.01814355
```

Question 2

Calculate the expected value and variance of the binomial distribution using the moment generating function.

Answer

To find E(X) and V(X) we need to start with the moment of the binomial distribution which is as follows: M(t)= [(1−p)+pe^t]^n

In order to find the values we need to take the first and the second derivative and solve them for at time t=0.

Using derivate we get: M'(t) = n(pe$^{t)[(1-p)+pe\text{^}t]}$(n−1) M'(0) = n*1[(1-p)+p]^(n-1) E(X) = np

M''(t) =n(n−1)(pe$^{t)}$2[(1−p)+pe^t]$^{(n-2)+n(pe}$t)[(1−p)+pe^t]^(n−1) M''(0) = np(1-p) sigma^2 = M"(0) −[M'(0)]^2 = n(n−1)p^2+np−(np)2=np(1−p)

Question 3

Calculate the expected value and variance of the exponential distribution using the moment generating function.

Answer

Using the same method above:

M(t)= l / (l-t)

Using derivate we get: M'(t) = l / (l-t)^2 M'(0) = 1 / l E(X) = 1 / l

M''(t) =2*l / (l-t)^3 M"(0)* = 2l / l^3 = 2/l$^{2\ \text{sigma}}$2 = M"(0) −[M'(0)]^2 = 2/l^2 - (1/l)^2 = 1/l^2