2. Sums and Products

Summation Notation

4/4 points (graded)
Compute the following sums. Enter your input using standard notation. (Refer to the “Standard Notation" button for help with input.)

1. $\sum_{i=0}^{N} 1 =$ N+1 ✔ **Answer:** N+1
   $N+1$
2. $\sum_{k=1}^{K}\sum_{t=1}^{T} 1 =$ K*T ✔ **Answer:** K*T
   $K \cdot T$
3. $\sum_{k=1}^{K}\sum_{t=1}^{T} 0.5^k =$ T*(1-0.5^K) ✔ **Answer:** T*(1-0.5^K)
   $T \cdot \left(1-0.5^K\right)$
4. $\sum_{k=1}^{\infty}\sum_{t=1}^{T} 0.5^k =$ T ✔ **Answer:** T

STANDARD NOTATION

Solution:

1. $$\sum_{i=0}^{N} 1 = \underbrace{1+\ldots+1}_{N+1\text{terms}} = N+1$$
2. $$\sum_{k=1}^{K}\sum_{t=1}^{T} 1 = KT$$
3.

$$\sum_{k=1}^{K}\sum_{t=1}^{T}(0.5)^k = \sum_{t=1}^{T}\left(\sum_{k=1}^{K}(0.5)^k\right) = T\left(0.5\sum_{k=0}^{K-1}(0.5)^k\right) = T\frac{0.5\left(1-0.5^K\right)}{1-0.5} = T\left(1-0.5^K\right)$$

where we have used the geometric sequence formula $\sum_{k=0}^{K-1} ar^k = \frac{a(1-r^K}{1-r}$.

4. $$\sum_{k=1}^{\infty}\sum_{t=1}^{T}(0.5)^k = \sum_{t=1}^{T}\left(\sum_{k=1}^{\infty}(0.5)^k\right) = T\frac{0.5}{1-0.5} = T$$

Recall the geometric series formula $\sum_{k=0}^{\infty} r^k = \frac{1}{1-r}$.

Submit You have used 0 of 3 attempts

Answers are displayed within the problem

Product Notation

2.0/2.0 points (graded)

The notation $\prod_{i=1}^{N} p_i$ denotes the product with N factors:

$$\prod_{i=1}^{N} p_i = p_1 p_2 \cdots p_N.$$

Compute the following products.

1. $\prod_{i=1}^{M}\frac{1}{\theta} =$ (1/theta)^M $\left(\frac{1}{\theta}\right)^M$ ✔ **Answer:** theta^(-M)

2. $\prod_{k=1}^{K}\frac{k}{k+1} =$ 1/(K+1) $\frac{1}{K+1}$ ✔ **Answer:** 1/(K+1)

3. $\ln\left(\prod_{k=1}^{K} e^k\right) =$ 1/2*K*(K+1) $\frac{1}{2}\cdot K\cdot(K+1)$ ✔ **Answer:** K*(K+1)/2

STANDARD NOTATION

Solution:

$$\prod_{i=1}^{M} \frac{1}{\theta} = \left(\frac{1}{\theta}\right)^{M}$$

2. $$\prod_{k=1}^{K} \frac{k}{k+1} = \frac{1}{2}\frac{2}{3}\cdots\frac{K-1}{K}\frac{K}{K+1} = \frac{1}{K+1}$$

3. $$\ln\left(\prod_{k=1}^{K} e^{k}\right) = \sum_{k=1}^{K} k = 1+2+\cdots+K = \frac{K(K+1)}{2}$$

Submit You have used 0 of 3 attempts

Answers are displayed within the problem

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