

Homework 7

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Let $X \sim \text{Pois}(\text{lambda})$. Find $E[X!]$. For what value of (lambda) does the expectation not exist?

$$P(X = k) = \frac{(e^{-\lambda} \cdot \lambda^k)}{k!}, \text{ so } E[X!] = \sum_{k=0}^{\infty} k! P(X = k) = \sum_{k=0}^{\infty} k! \left(\frac{(e^{-\lambda} \cdot \lambda^k)}{k!} \right) = e^{-\lambda} \sum_{k=0}^{\infty} \lambda^k = \frac{(e^{-\lambda})}{(1 - \lambda)}$$

```
E_X_factorial=function(lambda,k_max=1000) {  
  if (lambda >= 1) {  
    return(Inf)  
  }  
  k = 0:k_max  
  terms=lambda^k  
  sum_terms = sum(terms)  
  expect=exp(-lambda)*sum_terms  
  return(expect)  
}  
  
lambdas=c(0.1,0.5,0.9,0.99,1,2)  
for (lambda in lambdas) {  
  num=E_X_factorial(lambda)  
  print(sprintf("Lambda: %.2f, Output: %f", lambda, num))  
}
```

```
## [1] "Lambda: 0.10, Output: 1.005375"  
## [1] "Lambda: 0.50, Output: 1.213061"  
## [1] "Lambda: 0.90, Output: 4.065697"  
## [1] "Lambda: 0.99, Output: 37.156081"  
## [1] "Lambda: 1.00, Output: Inf"  
## [1] "Lambda: 2.00, Output: Inf"
```