Quiz 5

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#1. Write a function that will have two inputs : H (horizon: total time) and lambda (λ) (parameter for Exp. distribution)  
PoissonProcess <- function(H, lambda){  
 Time <- vector()  
 S <- vector()  
 Time[1] <- rexp(1,lambda)  
 S <- c(0.0,Time[1])  
   
 i<-2  
 while(S[i] < H){  
 val <- rexp(1,lambda)  
 if((val+S[i]) < H){  
 Time[i] <- val  
 S[i+1] <- Time[i] + S[i]  
 }else{  
 break  
 }  
 i<-i+1  
 }  
   
# Second While Loop Method  
# while(TRUE){  
# val <- rexp(1,lambda)  
# if((val+S[i]) > H){  
# break  
# }else{  
# Time[i] <- val  
# S[i+1] <- Time[i] + S[i]  
# }  
# i<-i+1  
# }  
   
 return(list(Time,S))  
}

#2. Test the function you developed in Question 1 using H= 5 and λ= 2.  
test <- PoissonProcess(5, 2)  
test

## [[1]]  
## [1] 0.8613958 3.1631749 0.1648417 0.0442139 0.1208516 0.1396736  
##   
## [[2]]  
## [1] 0.0000000 0.8613958 4.0245707 4.1894124 4.2336263 4.3544779 4.4941515

#3. Function Application:  
# Write a function to count the observations in a specific value range  
#Input: a real number vector X  
#Output: A vector V which its elements are the counts of appearance.  
CountFunction <- function(X){  
 V<- vector()  
 for(k in 1:(max(X)+1)){  
 V[k] <- 0  
 }  
   
 i<-1  
 while(i<=length(X)){  
 j<-0  
 while(j <= X[i]){  
 if(j+1 > X[i]){  
 V[j+1] <- V[j+1] + 1  
 }  
 j<-j+1  
 }  
 i<-i+1  
 }  
   
 return(V)  
}  
  
#4. Do this for 10,000 times  
#a) Apply the function in Question 1 with H=10, and λ=2  
#b) Apply the function in Problem 3 to the generated vector of arrival times in part (a)  
counted <- list()  
Times<-list()  
Ss<-list()  
  
for(i in 1:10000){  
 values <- PoissonProcess(10, 2)   
 Times <- values[[1]]  
 Ss <- values[[2]]  
 counted[[i]] <- CountFunction(values[[2]])  
}  
  
#c) What is the meaning of this average number?  
mean(Ss)

## [1] 5.315449

#This value means that the average arrival time is about 5.315449