HW7

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## Question 1.

1. Let X1, X2, . . . , Xn be n mutually independent random variables, each of which is uniformly distributed on the integers from 1 to k. Let Y denote the minimum of the Xi’s. Find the distribution of Y.

y= 1≤j≤k, ((k−j+1)**n−(k−j)**n)/kn

Question 2 2. Your organization owns a copier (future lawyers, etc.) or MRI (future doctors).This machine has a manufacturer’s expected ### lifetime of 10 years. This means that we expect one failure every ten years. (Include the probability statements and R Code for each part).

P(One failure in ten years)=1/10  
  
P(No failures in ten years)=9/10

1. What is the probability that the machine will fail after 8 years?. Provide also the expected value and standard deviation. Model as a geometric. (Hint: the probability is equivalent to not failing during the first 8 years.)

p = 1/10  
q = 9/10  
n=8  
  
year = 9  
v = vector()  
for (k in 1:year) {  
 v[k] = p\*(q^(k-1))  
   
}  
  
prob\_ofeight =round(pgeom(n,p,lower.tail = F),3)  
  
E\_x = 1/p  
  
sig = round(sqrt(1-p)/p,3)  
  
prob\_ofeight

## [1] 0.387

E\_x

## [1] 10

sig

## [1] 9.487

1. What is the probability that the machine will fail after 8 years?. Provide also the expected value and standard deviation. Model as an exponential.

lam = 1/10  
  
expo = round(exp(-n/10),3)  
rprob=round(pexp(p,n,lower.tail = F),3)  
  
gE\_x = 1/lam  
  
var = 1/lam^2  
  
std = 1/lam  
gE\_x

## [1] 10

var

## [1] 100

std

## [1] 10

1. What is the probability that the machine will fail after 8 years?. Provide also the expected value and standard deviation. Model as a binomial. (Hint: 0 success in 8 years)

pbin<- round(pbinom(q,n,p),3)  
  
bex <- round(n\*p,3)  
  
b\_stdx <- sqrt(n\*p\*q)  
  
bex

## [1] 0.8

b\_stdx

## [1] 0.8485281

1. What is the probability that the machine will fail after 8 years?. Provide also the expected value and standard deviation. Model as a Poisson.

plamb <- n\*p  
pe\_x <- plamb  
  
p\_prob =round(ppois(q,plamb),3)  
p\_std = round(sqrt(plamb),3)  
  
p\_prob

## [1] 0.449

p\_std

## [1] 0.894