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
```

a. 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
```

b. 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
```

c. 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
```

d. 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
```

```r
p_prob =round(ppois(q,plamb),3)
p_std = round(sqrt(plamb),3)

p_prob
```

```
## [1] 0.449
```

```r
p_std
```

```
## [1] 0.894
```