

# Data607 HW7

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## Question 1

1. Let  $X_1, X_2, \dots, X_n$  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  $X_i$ 's. Find the distribution of  $Y$

## 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.)
  - 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
ev <- 1/p
s_d <- sqrt((1 - p)/(p ^ 2))
p_8 <- ((1-p)^(8-1))*p
p
```

```
## [1] 0.1
```

```
ev
```

```
## [1] 10
```

```
s_d
```

```
## [1] 9.486833
```

```
p_8
```

```
## [1] 0.04782969
```

- 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
ev <- 1/lam
s_d <- sqrt(1/lam^2)
pexp(8, lam, lower.tail = FALSE)
```

```
## [1] 0.449329
```

```
ev
```

```
## [1] 10
```

```
s_d
```

```
## [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)

```
p <- 1/10
ev <- 8*p
s_d <- sqrt(8 * p * (1-p))
pbinom(0, 8, p, lower.tail = TRUE)
```

```
## [1] 0.4304672
```

```
ev
```

```
## [1] 0.8
```

```
s_d
```

```
## [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

```
ev <- 1/10
s_d <- sqrt(ev)
pois_1 <- ppois(0, ev, lower.tail = TRUE)
pois_1^8
```

```
## [1] 0.449329
```

```
ev
```

```
## [1] 0.1
```

```
s_d
```

```
## [1] 0.3162278
```