Assignment 4
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Course: Statistical Inference
Code: PMDS503P Slot: L33+L34

1   Question 1

```r
# part a

N <- 140
D <- 20
n <- 20

# Probability of 0 defective cards
P_X_0 <- phyper(0, D, N-D, n, lower.tail = FALSE)


# Probability of at least 1 defective card
P_X_at_least_1 <- 1 - P_X_0

cat("Probability of atleast 1 defective if 20 cards are defective is", P_X_at_least_1)

## Probability of atleast 1 defective if 20 cards are defective is 0.03561837

# part b

N <- 140
D <- 5
n <- 20

# Probability of 0 defective cards
P_X_0 <- phyper(0, D, N-D, n, lower.tail = FALSE)

# Probability of at least 1 defective card
P_X_at_least_1 <- 1 - P_X_0
cat("Probability of atleast 1 defective card if 5 cards are defective is", P_X_at_least_1)

## Probability of atleast 1 defective card if 5 cards are defective is 0.4570594
```

2   Question 2

```r
# part a

# Mean rate for 8 hours
lambda_8 <- 0.02 * 8

# Probability of 0 failures
P_X_0 <- dpois(0, lambda_8)
cat("Probability that the instrument does not fail in an 8-hour shift is ",P_X_0)

## Probability that the instrument does not fail in an 8-hour shift is  0.8521438

# part b

lambda_24 <- 0.02 * 24

# Probability of 0 failures
P_X_0 <- dpois(0, lambda_24)

# Probability of at least 1 failure
P_X_at_least_1 <- 1 - P_X_0
cat("Probability of atleast one failure in a 24-hour day is",P_X_at_least_1)

## Probability of atleast one failure in a 24-hour day is 0.3812166
```

3 Question 3

```r
# part a
mu <- 5
sigma <- 0.2

# Probability of X > 5.5
P_X_greater_5_5 <- 1 - pnorm(5.5, mean = mu, sd = sigma)
cat("Probability of covering thickness greater than 5.5 mm is ",P_X_greater_5_5)

## Probability of covering thickness greater than 5.5 mm is  0.006209665

# part b
P_X_between_4_5_and_5_5 <- pnorm(5.5, mean = mu, sd = sigma) - pnorm(4.5, mean = mu, sd = si

# Probability of not meeting specifications
P_X_not_meet_specs <- 1 - P_X_between_4_5_and_5_5
cat("If specifications require thickness between 4.5 and 5.5 , then proportions of coverings
```

```
## If specifications require thickness between 4.5 and 5.5 , then proportions of coverings t

# part c

x_95 <- qnorm(0.95, mean = mu, sd = sigma)
cat("Value below which 95% remain is ",x_95)

## Value below which 95% remain is  5.328971
```

4 Question 4

```
# part a

lambda <- 1 / 10

# Probability of X < 5
P_X_less_5 <- pexp(5, rate = lambda)
cat("Probability of time until the next class less than 5 mins is ",P_X_less_5)

## Probability of time until the next class less than 5 mins is  0.3934693

# part b

P_X_less_15 <- pexp(15, rate = lambda)

# Probability of 5 < X < 15
P_X_between_5_and_15 <- P_X_less_15 - P_X_less_5
cat("Probability that the time until next class is between 5 and 15 mins is ",P_X_between_5_

## Probability that the time until next class is between 5 and 15 mins is  0.3834005

# part c

t <- -log(0.10) / lambda
cat("Length of interval such that probability of atleast one call in the interval is 0.90 ",

## Length of interval such that probability of atleast one call in the interval is 0.90  23.
```