Week_3

2022-10-30

Q1

Simulate (s,S) inventory system using the calling sequence below.

```
set.seed(12345)
Y <- MySim(123, 2000, 55555)

### calculate 95% confidence intervals for point estimates
# mean
mean_95 <- c(mean(Y) + qnorm(0.975)*sd(Y)/length(Y),mean(Y) - qnorm(0.975)*sd(Y)/length(Y))
# 80% quantile
l_hat <- floor(length(Y)*0.8 - qnorm(0.975)*sqrt(length(Y)*0.8*(1-0.8)))
u_hat <- ceiling(length(Y)*0.8 + qnorm(0.975)*sqrt(length(Y)*0.8*(1-0.8)))
# prob Y>=210
prob_95 <- (length(Y)/(length(Y)-1))*sum(Y>=210)/length(Y)*(1-sum(Y>=210)/length(Y))
```

Using 2000 replications, the estimates are:

- mean: 193.4812

- standard deviation: 7.1717139

- 80th percentile of average cost: 199.6

- probability that cost is greater than or equal to \$210: 0.0105

- 95% confidence intervals on your point estimates:

    - mean: (193.4882282, 193.4741718)
    - 80th percentile: $[Y_{(1564)}, Y_{(1636)}]$
    - probability that cost is greater than or equal to \$210: ???

Q2: MSER statistic in the tandem queue system

(a)

Generate queue 1 and 2 waiting times with c(1,1) servers and probbaility 0.3 of skipping second queue.

Estimate deletion points.

```
mser_q1 <- MSER(Waits$Waits1)
mser_q2 <- MSER(Waits$Waits2)

dEstimated_q1 <- mser_q1$d
dEstimated_q2 <- mser_q2$d
```

The estimate of optimal number of waiting times to delete is 155 for queue 1 and 165 for queue 2.

```
df_q1 <- mser_q1 %>% as_tibble() %>% select(MSER) %>% rowid_to_column()
df_q2 <- mser_q2 %>% as_tibble() %>% select(MSER) %>% rowid_to_column()
```

```
# {plot(1:length(mser_q1$MSER),mser_q1$MSER,type="l")
# abline(v=dEstimated_q1,col="firebrick")
# text(x=320,y=0.1,label="deletion point estimate")}

# use ggplot instead to make nicer
ggplot(df_q1) + geom_line(aes(x=rowid,y=MSER)) +
  geom_vline(xintercept = dEstimated_q1,col="firebrick") +
  annotate("text", x=dEstimated_q1-30, y=0.07, label="deletion point", angle=90, size=3, color="firebri
  theme_minimal()
```
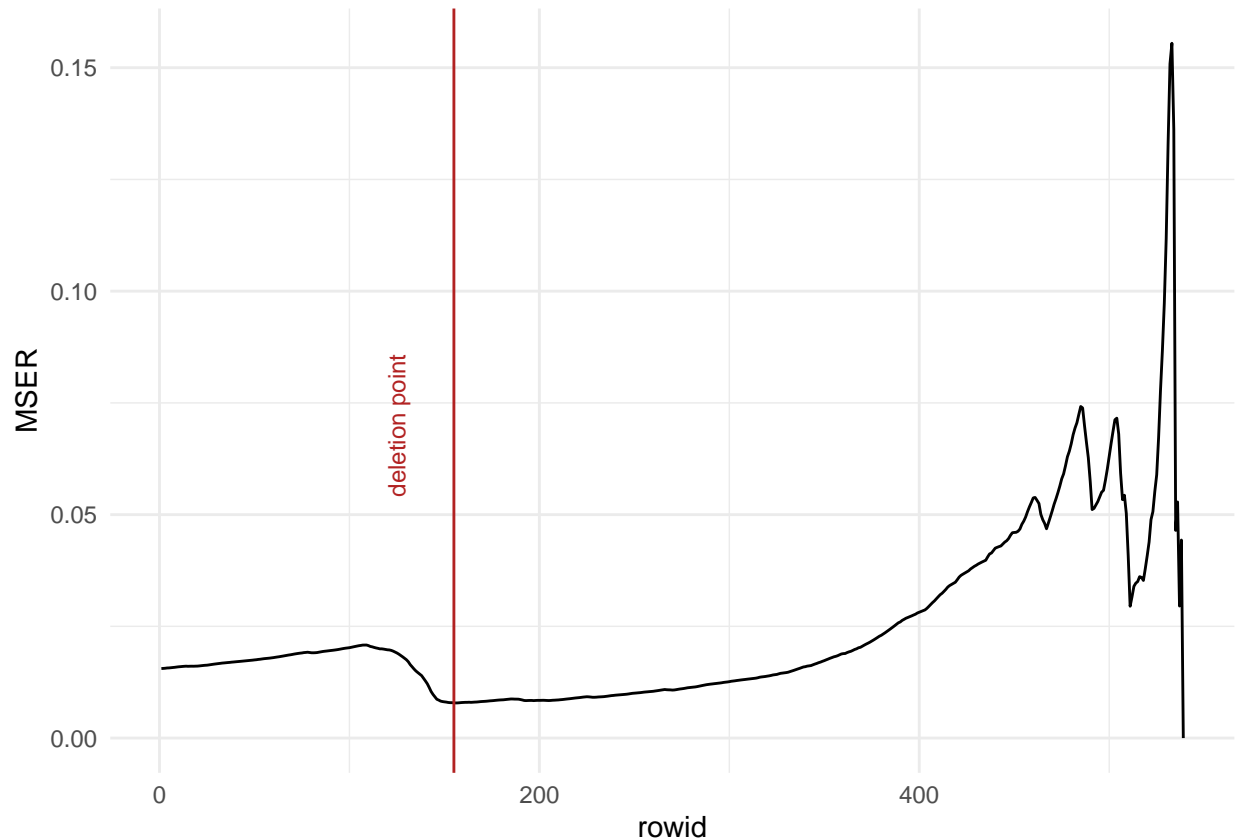

Figure 1: Plot of MSER statistic for queue 1.

```
# use ggplot instead to make nicer
ggplot(df_q2) + geom_line(aes(x=rowid,y=MSER)) + geom_vline(xintercept = dEstimated_q2,col="firebrick")
  annotate("text", x=dEstimated_q2-30, y=0.2, label="deletion point", angle=90, size=3, color="firebric
  theme_minimal()
```
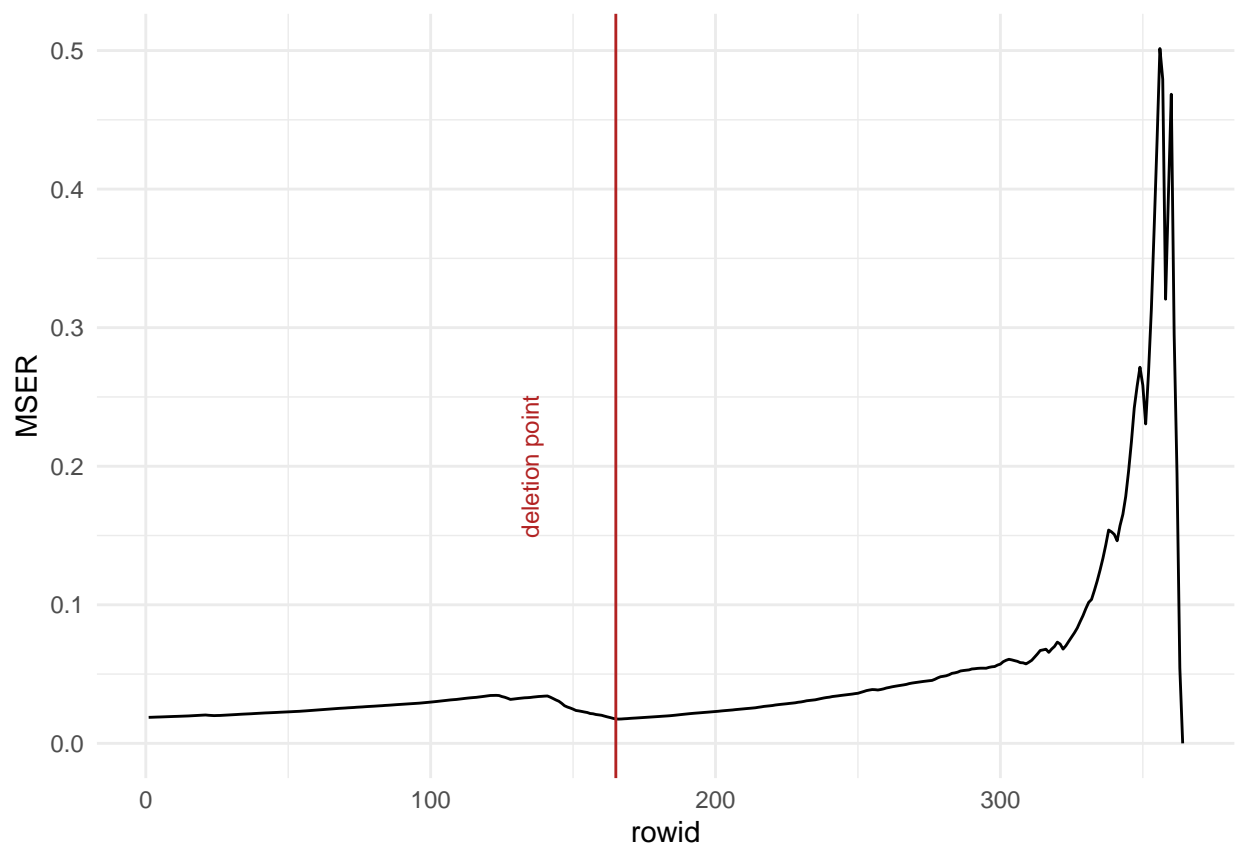
(b)

Figure 2: Plot of MSER statistic for queue 2.

```
set.seed(12345)
# run Tandem with given arguments
Waits <- Tandem(Starting.seed = 12345,c=c(1,1),Tend=5000)
mser_q1 <- MSER(Waits$Waits1)
mser_q2 <- MSER(Waits$Waits2)

dEstimated_q1 <- mser_q1$d
dEstimated_q2 <- mser_q2$d
```

The estimate of optimal number of waiting times to delete is 155 for queue 1 and 165 for queue 2. As there is more information (larger sample), the estimate can be more confident.