Case A simulation

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```
library(ggplot2)
library(dplyr)
```

```
##
##     'dplyr'

## The following objects are masked from 'package:stats':
##
##     filter, lag

## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```
non_congestedmu=log(35)
non_congestedsigma=log(5)
non_congested_prob=0.8
congestedmu=log(5)
congestedsigma=log(10)

get_speed <- function(r=1){
  i=1;result=c()
  congested=rbinom(r,1,(1-non_congested_prob))
  while (i<=r) {
    if(congested[1]==1)speed<-rlnorm(1,congestedmu,congestedsigma)
    else speed<-rlnorm(1,non_congestedmu,non_congestedsigma)
    result=c(result,speed)
    i<-i+1
  }
  result<- list(result,congested)
  names(result)<-c("speed","conjested")
  return(result)
}
```

replication of figure 1 in the Predictive Inference For Travel Time on Transportation Network.

```
set.seed(11111)
car1<-seq(0,100,1)
car1_speed<-get_speed(100)
car1_t<-c(0,car1_speed$speed)
car1_t_sum<-sum(car1_t)
car1_t_sum/60
```

```
## [1] 116.0091
```

```
car2_t_sum<-0
```

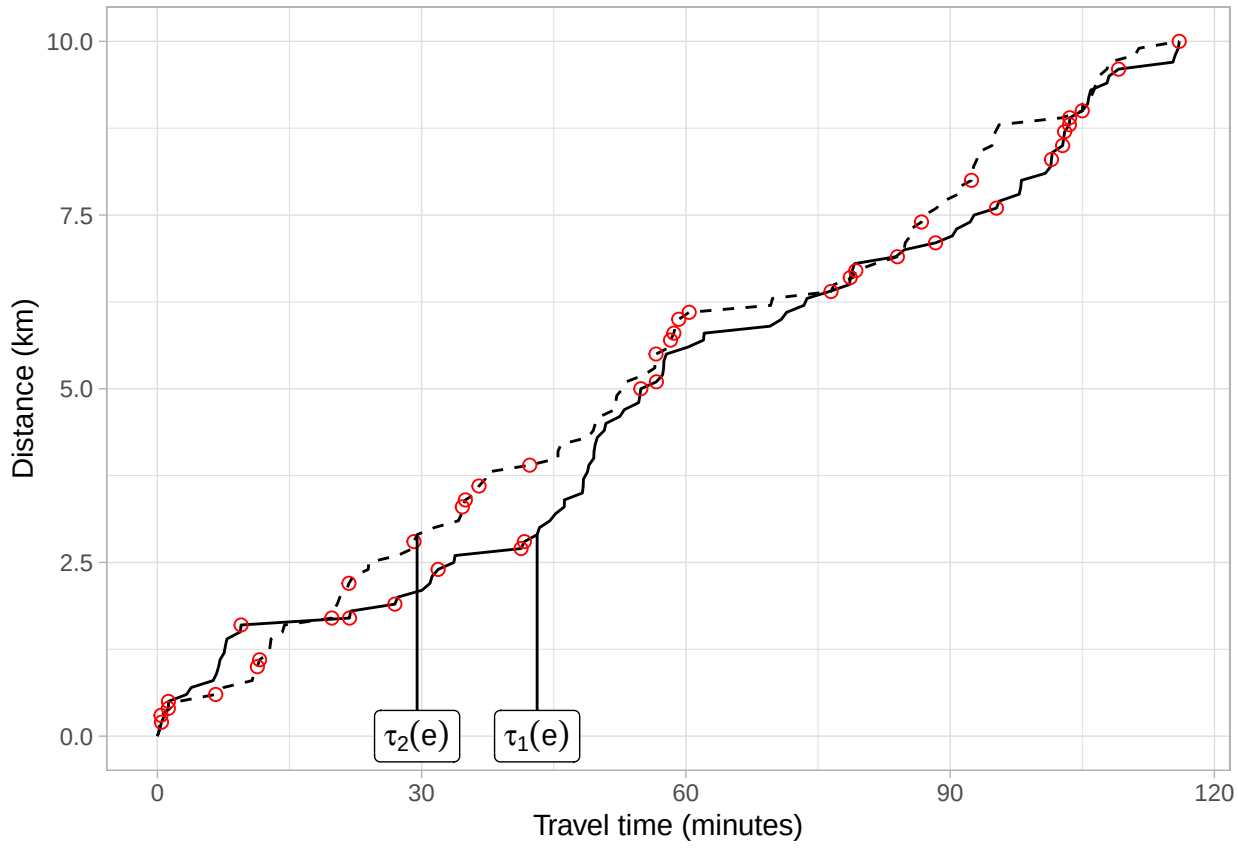
```
while (abs(car2_t_sum-car1_t_sum)>=1) {
  car2<-seq(0,100,1)
  car2_speed<-get_speed(100)
  car2_t<-c(0,car2_speed$speed)
  car2_t_sum<-sum(car2_t)

}
set.seed(NULL)
```

```
car1_cum_t <- cumsum(car1_t)/60
car2_cum_t <- cumsum(car2_t)/60
distance <- seq(0, 10, by = 0.1)
edgeind <- 30


data <- data.frame(distance = distance,
  travel_time1 = car1_cum_t,
  congested1 = c(0,car1_speed$conjested),
  travel_time2 = car2_cum_t,
  congested2 = c(0,car2_speed$conjested)
)
congested1_points <- data %>% filter(congested1 == 1)
congested2_points <- data %>% filter(congested2 == 1)

ggplot() +
  geom_line(data = data,
            aes(x = travel_time1, y = distance, color = "Car 1", linetype = "Car 1")) +
  geom_line(data = data,
            aes(x = travel_time2, y = distance, color = "Car 2", linetype = "Car 2")) +
  geom_point(data = congested1_points, aes(x = travel_time1, y = distance),
             color = "red", shape = 1, size = 2) +
  geom_point(data = congested2_points, aes(x = travel_time2, y = distance),
             color = "red", shape = 1, size = 2) +
  labs(x = "Travel time (minutes)", y = "Distance (km)", color = " ", linetype = " ") +
  theme_light() +
  theme(legend.position="none")+
  scale_color_manual(values = c("Car 1" = "black", "Car 2" = "black")) +
  scale_linetype_manual(values = c("Car 1" = "solid", "Car 2" = "dashed")) +
  geom_segment(aes(x = travel_time1, y = distance, yend =0, xend=data$travel_time1[edgeind]),data = subs
  geom_segment(aes(x = travel_time2, y = distance, yend =0, xend=data$travel_time2[edgeind]),data = subs
  geom_label(data = subset(data[edgeind,]),aes(x = c(travel_time1), y = c(0), label = list('tau[1](e)'))
  geom_label(data = subset(data[edgeind,]),aes(x = c(travel_time2), y = c(0), label = list('tau[2](e)'))
```



when set time=speed, the simulation result always produce a similar result as the one in the paper?

```
non_congestedmu=log(35)
non_congestedsigma=log(5)
non_congested_prob=0.8
congestedmu=log(5)
congestedsigma=log(10)

num_rides <-1000
average_travel_times_1 <- c()
average_travel_times_10 <- c()
average_travel_times_50 <- c()
average_travel_times_100 <- c()

for (i in 1:num_rides) {
  #time <- c(rep(100,1000)/get_speed(1000)$speed)
  time <- c(get_speed(1000)$speed)
  average_travel_times_100<-c(average_travel_times_100,sum(time[1:1000])/1000)
  average_travel_times_50<-c(average_travel_times_50,sum(time[1:500])/500)
  average_travel_times_10<-c(average_travel_times_10,sum(time[1:100])/100)
  average_travel_times_1<-c(average_travel_times_1,sum(time[1:10])/10)
}
```

```
data_density <- data.frame(
  Average_Travel_Time = c(average_travel_times_100, average_travel_times_50,
                          average_travel_times_10, average_travel_times_1),
```

```
  Route_Distance = factor(
    rep(c("100 km", "50 km", "10 km", "1 km"), each = num_rides),
    levels = c("100 km", "50 km", "10 km", "1 km")
  )
)

ggplot(data_density, aes(x = Average_Travel_Time, color = Route_Distance, linetype = Route_Distance)) +
  coord_cartesian(xlim = c(0, 200)) +
  geom_density(size = 1, adjust = 1.5) +
  labs(
    x = "Average travel time per edge (seconds)",
    y = "Empirical density",
    color = "Route distance",
    linetype = "Route distance"
  ) +
  theme_light() +
  scale_color_manual(values = c("black", "black", "black", "black")) +
  scale_linetype_manual(values = c("solid", "dashed", "dotted", "dotdash")) +
  guides(linetype = guide_legend(override.aes = list(linetype = c("solid", "dashed", "dotted", "dotdash
```

```
## Warning: Using `size` aesthetic for lines was deprecated in ggplot2 3.4.0.
## i Please use `linewidth` instead.
## This warning is displayed once every 8 hours.
## Call `lifecycle::last_lifecycle_warnings()` to see where this warning was
## generated.
```