# 01_proc_HPP

Frances Lin

4/15/2021

```r
library(tidyverse)
library(ggplot2)
library(patchwork)
```

```r
set.seed(1) # for reproducibility

t_max <- 10
t <- 0

lmbda <- 10

X <- numeric(0) # vector of t

while(t <= t_max){
  u       <- runif(1)
  t       <-  t - log(u)/lmbda            # t ~ exp(1/lambda)
  if(t < t_max) {
    X <- c(X,t)                           # update index
  }
}
```

```r
# Check to see if the total #s matches
length(X)
```

```
## [1] 114
```

```r
# Create dataframe
df_HPP = tibble(
  x = X,
  y = 1:(length(X)) #0:(length(X) - 1)
)

# Plot HPP
p_HPP <- ggplot(data=df_HPP, mapping=aes(x=x, y=y)) +
  geom_step() +
  labs(title = "Homogeneous Poisson Process (lambda = 10)",
       x = "t",
       y = "N(t)") +
  xlim(0, 10) # so that scale lines up
#p_HPP

# # Can probably delete
# df_HPP <- df_HPP %>% add_column(
#   t_fix = rep(2, length(df_HPP$x))
# )
```

```
# Plot time plot
p_HPP_time <- ggplot(data=df_HPP, mapping=aes(x=x, ymin = -0.5, ymax = 0.5)) +
  geom_linerange() +
  geom_hline(aes(yintercept = 0), linetype = "dashed") +
  labs(title = "Corresponding Inter-Arrivial Times",
       x = "t",
       y = "") +
  scale_x_continuous(limits = c(0, 10), breaks = seq(0, 10, by = 1)) +
  theme(axis.text.y=element_blank(), axis.ticks.y=element_blank())
#p_HPP_time
```

```
# Plot lambda (rate)
p_HPP_hist <- ggplot(data=df_HPP, mapping=aes(x=x)) +
  geom_histogram(bins = 11, color = "white") +
  labs(title = "Rate/Intensity",
       x = "t",
       y = "lambda") +
  xlim(0, 10) # so that scale lines up
#p_HPP_hist
```
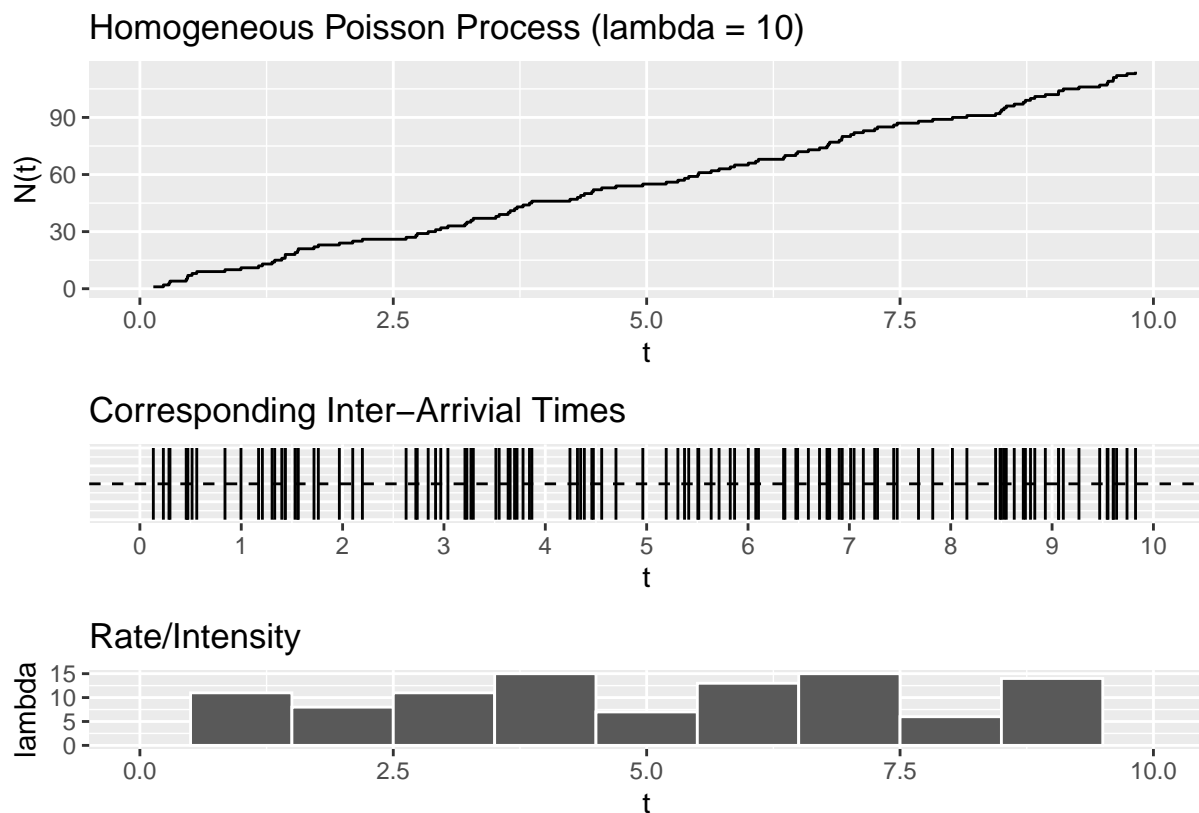
```
# Combine plots
# require(gridExtra)
# grid.arrange(p_HPP, p_HPP_time)
p_HPP / p_HPP_time / p_HPP_hist + plot_layout(heights = c(0.6, 0.2, 0.2))
```

```
## Warning: Removed 2 rows containing missing values (geom_bar).
```

```
# Save output and adjust size
png(file = '/Users/franceslinyc/Hawkes-Process-2021/results/plot_1D_HPP.png', width = 450*2, height = 45
p_HPP / p_HPP_time / p_HPP_hist + plot_layout(heights = c(0.7, 0.1, 0.2))
```

## Warning: Removed 2 rows containing missing values (geom_bar).