

# 01\_\_proc\_\_HPP

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

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

# Set value
lambda <- 10
t_max <- 10

# Initialize
t <- 0
t_vec <- numeric(0) # vector of t

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

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

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

```
# Create dataframe
df_HPP = tibble(
  x = t_vec,
  y = 1:(length(t_vec)) #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))
# )
```

```
# )

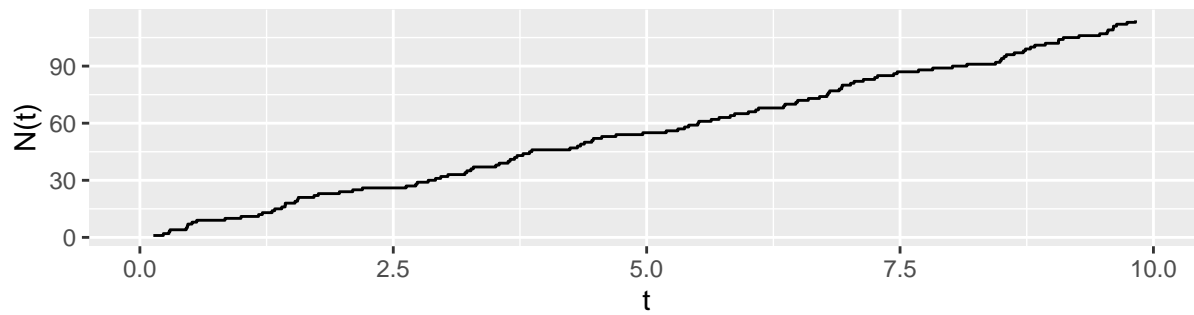
# Plot time plot
p_HPP_time <- ggplot(data=df_HPP, mapping=aes(x=x, ymin = -0.5, ymax = 0.5)) +
  geom_linerange() +
  geom_hline(aes(yintercept = 0), linetype = "dashed") +
  labs(title = "Corresponding Inter-Arrival Times",
        x = "t",
        y = "") +
  scale_x_continuous(limits = c(0, 10), 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
```

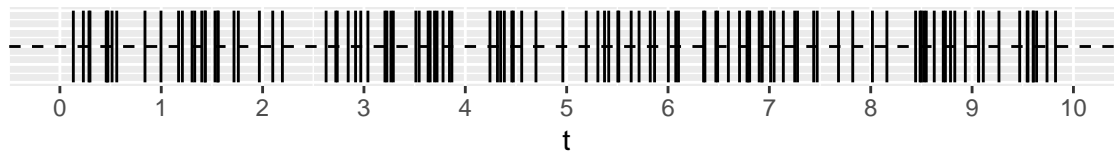
```
# Combine plots
# require(gridExtra)
# grid.arrange(p_HPP, p_HPP_time)
p_HPP / p_HPP_time / p_HPP_hist + plot_layout(heights = c(0.6, 0.2, 0.2))
```

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

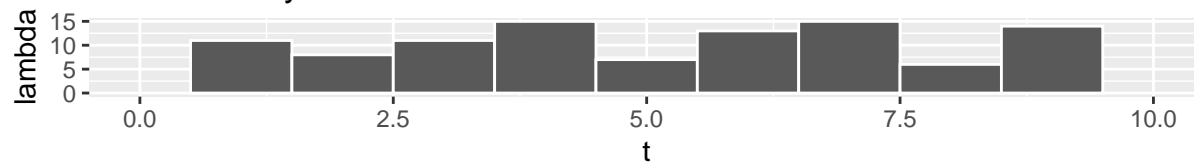
### Homogeneous Poisson Process ( $\lambda = 10$ )



### Corresponding Inter-Arrival Times



### Rate/Intensity



```
# Save output and adjust size
png(file = '/Users/franceslinyc/Hawkes-Process-2021/results/plot_1D_HPP.png', width = 450*2, height = 450)
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).
```