Project 1 Solution

IE384 Simulation Models in IE

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1 Introduction

2 Objective

3 Problem Statement

4 Data Analysis

We fit several distributions to the two datasets determine which was the best fit so that the distributions could be used in the simulation rather than sampling the raw data. This gives a more complete view of possible values which could be observed. We use Pham's Criteria (PC) as shown in Equation 1 to assess the best fit distribution as it accounts for the number of parameters in the distribution and the number of observations.

$$PC = \left(\frac{n-k}{2}\right) \log\left(\frac{SSE}{n}\right) + k\left(\frac{n-1}{n-k}\right) \tag{1}$$

Our candidate distributions included; exponential, uniform, 2-parameter exponential, normal, lognormal, gamma, beta, Weibull, and Rayleigh.

```
cand_dists <- c("exp", "unif", "tpexp", "norm", "lnorm", "gamma", "beta", "weibull", "rayleig
```

4.1 Travel Time

The travel time data are shown in the histogram in Figure 1.

```
no_delay_traffic_data <- tibble(
  travel_time = c(19.5, 22.5, 18.9, 18.9, 18.8, 23.4, 23.2, 22.7, 22.3, 19.9, 21.4, 22.7, 19
)
```

```
no_delay_traffic_data |> ggplot(aes(x=travel_time)) +
  geom_histogram() +
  labs(
    x = "Travel Time (min)"
  )
```

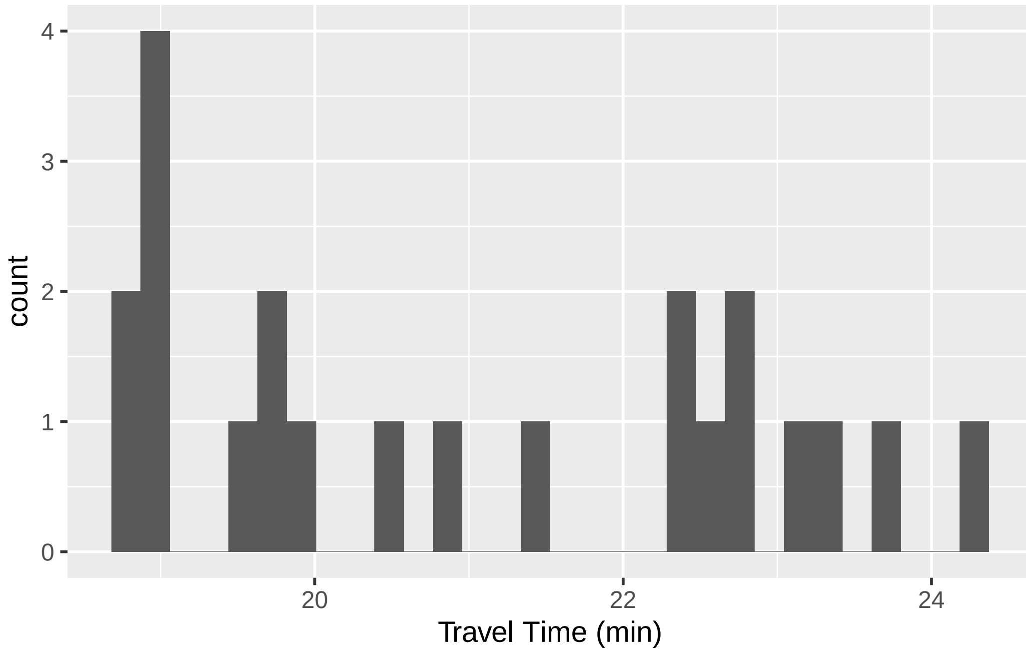

Figure 1: Travel Time Histogram

4.2 Red Light Delay

```
red_light_data <- tibble(
  delay_time = c(0.86, 0.68, 0.68, 0.76, 0.57, 0.49, 0.47, 0.29, 0.79, 0.19, 0.18, 0.63, 0.5
```

```r
red_light_data |> ggplot(aes(x=delay_time)) +
  geom_histogram() +
  labs(
    x = "Delay Time (min)"
  )
```

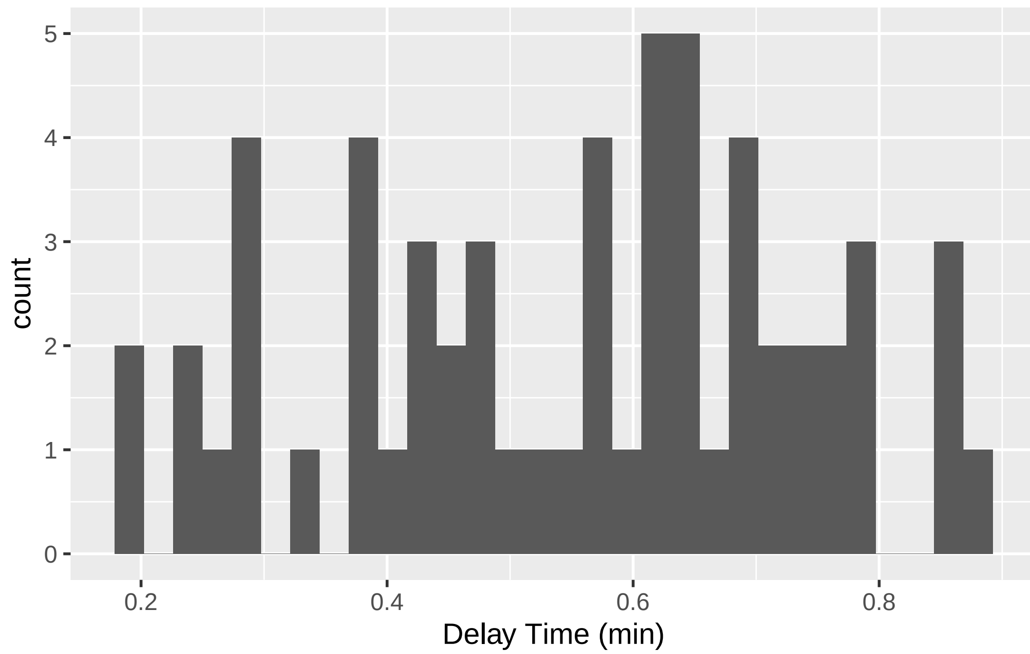

Figure 2: Histogram of Delay per Red Light

5 Modeling Analysis

5.1 Simulation Model

5.2 Analytical Model

6 Results

7 Conclusions and Findings