

## cluster-destination-timeofday

```
library(conflicted)
library(tidyverse)
library(rlang)
library(gt)
  library(gtExtras)
conflicts_prefer(dplyr::filter)
```

```
unzip(zipfile = "passenger_data.zip")
data = "passenger_data.csv" |>
  read_csv(
    col_types = cols(
      Wait_Time = col_integer(),
      C_Start = col_integer(),
      CO = col_integer(),
      C_avg = col_double(),
      BFO_Dest_City = col_factor(),
      BFO_Destination_Country_Code = col_factor(),
      order = col_integer(),
      Pass_ID = col_integer(),
      Time_of_Day = col_integer(),
      Period_of_Week = col_factor(),
      Day_of_Week = col_factor(),
      Month = col_factor(),
      Season = col_factor(),
      Year = col_factor(),
      Flight_ID = col_integer(),
      Delay_in_Seconds = col_integer(),
      .default = col_guess()
    )
  ) |>
  select(!Airfield) # all observations are from AUC
```

```
data = data |>
  mutate(
    BFO_Dest_City_or_CC = if_else( # split cities in Borealia, Vespuchia
      BFO_Destination_Country_Code %in% c("BOR", "VES"),
      true = BFO_Dest_City,
      false = BFO_Destination_Country_Code
    ) |>
    as_factor(),
    .after = BFO_Destination_Country_Code
  )
```

```

c1 = data |>
  summarise(
    n = n(),
    .by = c(
      Time_of_Day,
      BFO_Dest_City_or_CC
    )
  ) |>
  mutate(
    hour_start = case_when(
      Time_of_Day == 1 ~ "0:00",
      Time_of_Day == 2 ~ "6:00",
      Time_of_Day == 3 ~ "12:00",
      Time_of_Day == 4 ~ "18:00"
    ),
    hour_end = case_when(
      Time_of_Day == 1 ~ "6:00",
      Time_of_Day == 2 ~ "12:00",
      Time_of_Day == 3 ~ "18:00",
      Time_of_Day == 4 ~ "0:00"
    ),
    hours = 732,
    type = if_else(
      BFO_Dest_City_or_CC %in% c("QUE", "AUC", "SAF", "CWL"),
      true = "Domestic",
      false = "International"
    ) |>
    as_factor(),
    rate = n/732 # number of hours: 732 apiece
  ) |>
  filter(n > 20) |>
  relocate(BFO_Dest_City_or_CC, .after = hours) |>
  relocate(n, .before = rate) |>
  arrange(
    Time_of_Day,
    BFO_Dest_City_or_CC
  ) |>
  mutate( # change how Time_of_Day is displayed, **after** it's been ordered
    Time_of_Day = case_when(
      Time_of_Day == 1 ~ "Night",
      Time_of_Day == 2 ~ "Morning",
      Time_of_Day == 3 ~ "Afternoon",
      Time_of_Day == 4 ~ "Evening"
    )
  ) |>
  group_by(Time_of_Day)

gt(c1) |>
  tab_header(
    title = "Average passenger arrival rates at **AUC**" |>
      md(),
    subtitle = "by destination and time of day"
  ) |>

```

```
cols_label(
  Time_of_Day = "Time",
  hour_start = "",
  hour_end = "",
  BFO_Dest_City_or_CC = "Destination",
  hours = "Hours",
  type = "Type",
  n = "Count",
  rate = "Arrivals/hour"
) |>
tab_options(
  row_group.as_column = TRUE
)
```

Average passenger arrival rates at **AUC**  
by destination and time of day

|           |       |       | Hours | Destination | Type          | Count | Arrivals/hour |
|-----------|-------|-------|-------|-------------|---------------|-------|---------------|
| Night     | 0:00  | 6:00  | 732   | QUE         | Domestic      | 77    | 0.1051913     |
| Morning   | 6:00  | 12:00 | 732   | QUE         | Domestic      | 16461 | 22.4877049    |
|           | 6:00  | 12:00 | 732   | VES033      | International | 3694  | 5.0464481     |
|           | 6:00  | 12:00 | 732   | VES064      | International | 2983  | 4.0751366     |
|           | 6:00  | 12:00 | 732   | CWL         | Domestic      | 11117 | 15.1871585    |
|           | 6:00  | 12:00 | 732   | SAF         | Domestic      | 2001  | 2.7336066     |
|           | 6:00  | 12:00 | 732   | NEN         | International | 1064  | 1.4535519     |
|           | 6:00  | 12:00 | 732   | SCO         | International | 230   | 0.3142077     |
| Afternoon | 12:00 | 18:00 | 732   | QUE         | Domestic      | 20379 | 27.8401639    |
|           | 12:00 | 18:00 | 732   | VES033      | International | 7272  | 9.9344262     |
|           | 12:00 | 18:00 | 732   | VES064      | International | 3312  | 4.5245902     |
|           | 12:00 | 18:00 | 732   | CWL         | Domestic      | 9153  | 12.5040984    |
|           | 12:00 | 18:00 | 732   | SAF         | Domestic      | 533   | 0.7281421     |
|           | 12:00 | 18:00 | 732   | SCO         | International | 727   | 0.9931694     |
| Evening   | 18:00 | 0:00  | 732   | QUE         | Domestic      | 15151 | 20.6980874    |
|           | 18:00 | 0:00  | 732   | VES033      | International | 3308  | 4.5191257     |
|           | 18:00 | 0:00  | 732   | VES064      | International | 2258  | 3.0846995     |
|           | 18:00 | 0:00  | 732   | CWL         | Domestic      | 4634  | 6.3306011     |
|           | 18:00 | 0:00  | 732   | SAF         | Domestic      | 3045  | 4.1598361     |
|           | 18:00 | 0:00  | 732   | NEN         | International | 1678  | 2.2923497     |
|           | 18:00 | 0:00  | 732   | SCO         | International | 4679  | 6.3920765     |

```
dist = data |>
  summarise(
    avg_servers = mean(C0),
    .by = c(
      Time_of_Day,
      BFO_Dest_City_or_CC
    )
  ) |>
  filter(BFO_Dest_City_or_CC %in% c1$BFO_Dest_City_or_CC) |>
  filter(Time_of_Day != 1 | BFO_Dest_City_or_CC != "VES033") |>
  arrange(
```

```

      Time_of_Day,
      BFO_Dest_City_or_CC
    )
dist2 = data |>
  summarise(
    n = n(),
    .by = c(
      Time_of_Day,
      BFO_Dest_City_or_CC,
      C0
    )
  ) |>
  filter(BFO_Dest_City_or_CC %in% c1$BFO_Dest_City_or_CC) |>
  filter(Time_of_Day != 1 | BFO_Dest_City_or_CC != "VES033")
dist2 = dist2 |>
  mutate(
    total = sum(n),
    srv1 = if_else(
      C0 == 1,
      true = n/total*100,
      false = 0
    ),
    srv2 = if_else(
      C0 == 2,
      true = n/total*100,
      false = 0
    ),
    srv3 = if_else(
      C0 == 3,
      true = n/total*100,
      false = 0
    ),
    .by = c(
      Time_of_Day,
      BFO_Dest_City_or_CC
    )
  ) |>
  arrange(
    Time_of_Day,
    BFO_Dest_City_or_CC,
    C0
  ) |>
  summarise(
    across(srv1:srv3, sum),
    .by = c(
      Time_of_Day,
      BFO_Dest_City_or_CC
    )
  )
)

```

```

joindist = dist |>
  left_join(
    dist2,

```

```

    by = join_by(
      Time_of_Day,
      BFO_Dest_City_or_CC
    )
  )
)

```

```

cl2 = joindist |>
  mutate(
    hour_start = case_when(
      Time_of_Day == 1 ~ "0:00",
      Time_of_Day == 2 ~ "6:00",
      Time_of_Day == 3 ~ "12:00",
      Time_of_Day == 4 ~ "18:00"
    ),
    hour_end = case_when(
      Time_of_Day == 1 ~ "6:00",
      Time_of_Day == 2 ~ "12:00",
      Time_of_Day == 3 ~ "18:00",
      Time_of_Day == 4 ~ "0:00"
    ),
    .after = Time_of_Day
  ) |>
  mutate(
    type = if_else(
      BFO_Dest_City_or_CC %in% c("QUE", "AUC", "SAF", "CWL"),
      true = "Domestic",
      false = "International"
    ),
    .after = BFO_Dest_City_or_CC
  ) |>
  arrange(
    Time_of_Day,
    BFO_Dest_City_or_CC
  ) |>
  mutate( # change how Time_of_Day is displayed, **after** it's been ordered
    Time_of_Day = case_when(
      Time_of_Day == 1 ~ "Night",
      Time_of_Day == 2 ~ "Morning",
      Time_of_Day == 3 ~ "Afternoon",
      Time_of_Day == 4 ~ "Evening"
    )
  ) |>
  group_by(Time_of_Day)

gt(cl2) |>
  tab_header(
    title = "Average number of servers at **AUC**" |>
      md(),
    subtitle = "by destination and time of day"
  ) |>
  cols_label(
    Time_of_Day = "Time",
    hour_start = "",

```

```

hour_end = "",
BF0_Dest_City_or_CC = "Destination",
type = "Type",
avg_servers = "Avg. # Servers",
srv1 = "1",
srv2 = "2",
srv3 = "3"
) |>
tab_spanner(
  label = "Customers served with # of active servers",
  columns = c(srv1:srv3)
) |>
tab_options(
  row_group.as_column = TRUE
)

```

Average number of servers at **AUC**  
by destination and time of day

|           |       |             |        |               |                | Customers served with # of active servers |          |            |
|-----------|-------|-------------|--------|---------------|----------------|---|----------|------------|
|           |       | Destination |        | Type          | Avg. # Servers | 1   | 2        | 3          |
| Night     | 0:00  | 6:00        | QUE    | Domestic      | 1.220779       | 77.92208                                  | 22.07792 | 0.00000000 |
| Morning   | 6:00  | 12:00       | QUE    | Domestic      | 1.678634       | 34.53618                                  | 63.06421 | 2.39961120 |
|           | 6:00  | 12:00       | VES033 | International | 1.811586       | 23.01029                                  | 72.82079 | 4.16892258 |
|           | 6:00  | 12:00       | VES064 | International | 1.658733       | 36.00402                                  | 62.11867 | 1.87730473 |
|           | 6:00  | 12:00       | CWL    | Domestic      | 1.442296       | 57.58748                                  | 40.59548 | 1.81703697 |
|           | 6:00  | 12:00       | SAF    | Domestic      | 1.593203       | 40.72964                                  | 59.22039 | 0.04997501 |
|           | 6:00  | 12:00       | NEN    | International | 1.173872       | 82.80075                                  | 17.01128 | 0.18796992 |
|           | 6:00  | 12:00       | SCO    | International | 1.469565       | 53.04348                                  | 46.95652 | 0.00000000 |
| Afternoon | 12:00 | 18:00       | QUE    | Domestic      | 1.210707       | 79.38564                                  | 20.15801 | 0.45635213 |
|           | 12:00 | 18:00       | VES033 | International | 1.092959       | 90.70407                                  | 9.29593  | 0.00000000 |
|           | 12:00 | 18:00       | VES064 | International | 1.066425       | 93.59903                                  | 6.15942  | 0.24154589 |
|           | 12:00 | 18:00       | CWL    | Domestic      | 1.236971       | 76.77264                                  | 22.75757 | 0.46979133 |
|           | 12:00 | 18:00       | SAF    | Domestic      | 1.341463       | 65.85366                                  | 34.14634 | 0.00000000 |
|           | 12:00 | 18:00       | NEN    | International | 1.000000       | 100.00000                                 | 0.00000  | 0.00000000 |
|           | 12:00 | 18:00       | SCO    | International | 1.588721       | 48.83081                                  | 43.46630 | 7.70288858 |
| Evening   | 18:00 | 0:00        | QUE    | Domestic      | 1.245726       | 76.36460                                  | 22.69817 | 0.93723187 |
|           | 18:00 | 0:00        | VES033 | International | 1.370314       | 65.08464                                  | 32.79927 | 2.11608222 |
|           | 18:00 | 0:00        | VES064 | International | 1.405669       | 61.38175                                  | 36.66962 | 1.94862710 |
|           | 18:00 | 0:00        | CWL    | Domestic      | 1.361027       | 65.12732                                  | 33.64264 | 1.23003884 |
|           | 18:00 | 0:00        | SAF    | Domestic      | 1.678161       | 35.04105                                  | 62.10181 | 2.85714286 |
|           | 18:00 | 0:00        | NEN    | International | 1.302741       | 70.50060                                  | 28.72467 | 0.77473182 |
|           | 18:00 | 0:00        | SCO    | International | 1.589228       | 45.22334                                  | 50.63048 | 4.14618508 |