

ETC 2420/5242 Lab 9 2016

Di Cook

Week 9

Purpose

In this lab we will model risk and loss for running a coffee shop in downtown Melbourne using the pedestrian traffic data and weather data. We are going to play a game!

Details of the game

- Two players (two teams compete against each other)
- Records for two locations in Melbourne are used: “Melbourne Central”, “Flinders Street Station Underpass”. Pick which location you want to open a coffee shop. If the teams cannot decide, flip a coin.
- At Flinders, the proportion of pedestrians passing by who will buy a coffee is 0.1 between 7-10am, 0.05 between 10-4, 0.01 between 4-8. At Melbourne Central, the proportion who will buy coffee is 0.08 between 7-10am, 0.06 between 10-4, 0.02 between 4-10pm. At all other times assume no purchases.
- Each coffee purchase is \$4.
- To open the coffee shop with one attendant costs \$100/hour. Two attendants is \$150/hour. Three attendants is \$200/hour and four attendants is \$250/hour. One attendant per hour can handle 50 customers, if the number is more than the number the staff can handle the customers will walk out without purchasing.
- Decide what hours you will open your coffee shop, and how many attendants you will have working for each hour. You can have different numbers of attendees for each hour. You can be open no more than 8 hours per day, and the hours open can be different by day of the week. The same pattern, though, is used for every week, all months.
- You will play 10 rounds of the game, which will randomly select a day, time of day and simulate the pedestrian counts at each site. You will need to tally up costs and profits, using the function `compute_earnings` provided. (Fractions are rounded to the nearest integer.)
- Winning team is the one with more earnings.

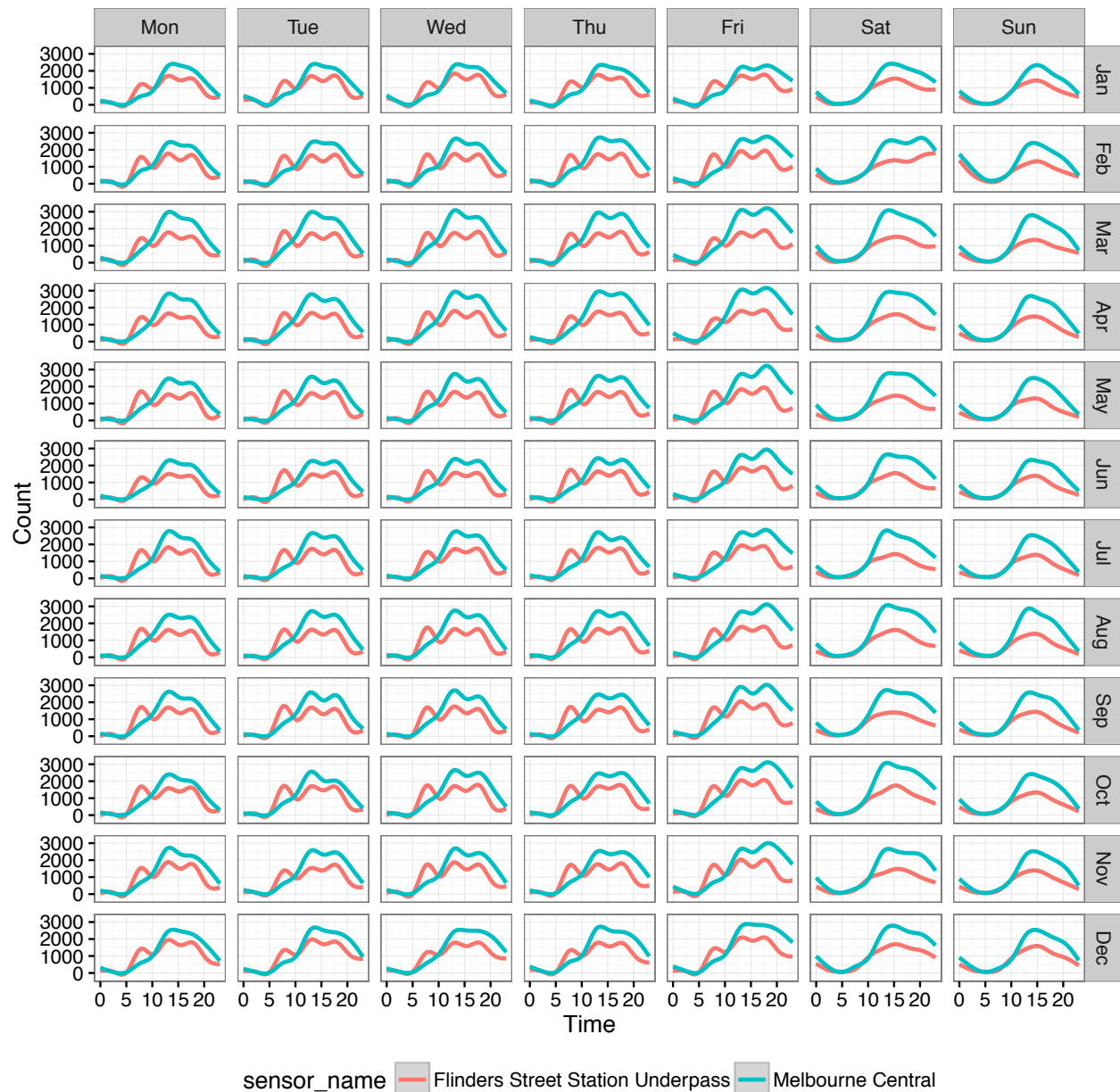
| | Flinders St | | | | | | |
|----|-------------|-----|-----|-----|-----|-----|-----|
| | Mon | Tue | Wed | Thu | Fri | Sat | Sun |
| 7 | | | | | | | |
| 8 | | | | | | | |
| 9 | | | | | | | |
| 10 | | | | | | | |
| 11 | | | | | | | |
| 12 | | | | | | | |
| 1 | | | | | | | |
| 2 | | | | | | | |
| 3 | | | | | | | |
| 4 | | | | | | | |
| 5 | | | | | | | |
| 6 | | | | | | | |
| 7 | | | | | | | |
| 8 | | | | | | | |
| 9 | | | | | | | |

| | Melbourne Central | | | | | | |
|----|-------------------|-----|-----|-----|-----|-----|-----|
| | Mon | Tue | Wed | Thu | Fri | Sat | Sun |
| 7 | | | | | | | |
| 8 | | | | | | | |
| 9 | | | | | | | |
| 10 | | | | | | | |
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| 1 | | | | | | | |
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| 3 | | | | | | | |
| 4 | | | | | | | |
| 5 | | | | | | | |
| 6 | | | | | | | |
| 7 | | | | | | | |
| 8 | | | | | | | |
| 9 | | | | | | | |

Models

You are provided with a fitted model for pedestrian traffic, which was built using this code.

```
ped_weather <- read_csv("../data/melb_ped_weather.csv")
ped_weather_sub <- ped_weather %>%
  filter(sensor_name %in% c("Melbourne Central",
    "Flinders Street Station Underpass"))
ped_weath_sub_glm <- glm(count~day*time*month*sensor_name+
  high_tmp+low_tmp+high_prcp,
  data=ped_weather_sub, family=poisson(link="log"))
save(ped_weath_sub_glm, file="../data/ped_weather_sub_glm.rda")
```



Game code

```
sample_day_time <- function(){
  sel_date <- sample(ped_weather_sub$date, 1)
  sel_time <- sample(7:21, 1)
  return(list(sel_date, sel_time))
}
dt <- sample_day_time()
dt
compute_earnings <- function(sel_date, sel_time, Fl_attendants=1, MC_attendants=1) {
  Fl_rate <- c(rep(0.1, 3), rep(0.05, 6), rep(0.01, 4), rep(0, 2))[sel_time-6]
  MC_rate <- c(rep(0.08, 3), rep(0.06, 6), rep(0.02, 6))[sel_time-6]
  ped_sim <- ped_weather_sub
  ped_sim$new1 <- simulate(ped_weath_sub_glm)$sim_1
  ped_sim_sub <- ped_sim %>% filter(date == sel_date, time == sel_time)
  Fl_count <- ped_sim_sub %>%
    filter(sensor_name == "Flinders Street Station Underpass") %>%
    select(new1)
  MC_count <- ped_sim_sub %>%
    filter(sensor_name == "Melbourne Central") %>%
    select(new1)
  Fl <- 0
  MC <- 0
  if (nrow(Fl_count) > 0) Fl <- min(round(Fl_count*Fl_rate, 0), 50*Fl_attendants)
  if (nrow(MC_count) > 0) MC <- min(round(MC_count*MC_rate, 0), 50*MC_attendants)
  Fl_earn <- 0
  MC_earn <- 0
  if (Fl > 0) Fl_earn <- Fl*4 - (100+50*(Fl_attendants-1))
  if (MC > 0) MC_earn <- MC*4 - (100+50*(MC_attendants-1))
  return(list(Fl_earn, MC_earn))
}
compute_earnings(dt[[1]], dt[[2]], 1, 2)
```

Question 1

Write down the equation of the model that was used to play the game.

Question 2

- Simulate 10 sets of new values using the `simulate` function.
- Subset to examine only records for March 28, 9am. (What day of the week is this?)
- Summarise the distribution of the 10 values for the two locations, and compare with the actual count.
- If you are open, have three attendants at Flinders and two attendants at Melbourne Central, how much would you make at most, and at least under these conditions, at each location?

Question 3

- Now extend this to the full day (between 7am-10pm, closing at 10pm), keep the same number of attendants for the full day. How much in profit do you make at most, and at the lowest at each location?

- b. Suppose that the weather for the day is actually a hot day. How does this affect your profits? (Predict the counts for both locations for the hot and not hot day, and compute the difference. Subtract this number from your simulation values - because these were for a not hot day.)

Question 4

- a. Now scale your calculations up for the full month of March (assuming that you are open 7 days a week). How much do you earn at most, and at worst? At both locations, assuming the same weather conditions as in the given data.
- b. During the month your coffee machine breaks, and you need to buy a new one. The new one costs \$20000. Can you afford it?

TURN IN

- Your .Rmd file
- Your Word (or pdf) file that results from knitting the Rmd.
- Make sure your group members are listed as authors, one person per group will turn in the report
- DUE: Wednesday after the lab, by 7am, loaded into moodle