Lab 02

CS3172-1, Spring 2023, Effat University

Lamar Aljahdali

Packages

```
library(tidyverse)
library(scales)
```

Data

```
cas <- read_rds("data/canada_survey.rds")
```

Tasks

Task 1

```
cas<-filter(cas,energy_expense>0,household_income>0)
```

```
cas<-mutate(cas,marital_status = factor(marital_status))
```

Task 2

```
cas<-mutate(cas,heat_equip = case_when(heat_equip == 1 ~ "steam",
 heat_equip == 2 ~ "forced air",
 heat_equip == 3 ~ "stove",
 heat_equip == 4 ~ "electric heating"))
```

```
cas<-mutate(cas,heat_fuel = case_when(heat_fuel == 1 ~ "oil",
 heat_fuel == 2 ~ "gas",
 heat_fuel == 3 ~ "electricity",
 heat_fuel == 4 ~ "other"))
```

Task 3

```
cas_hftandhe<-cas %>% group_by(heat_equip, heat_fuel) %>% summarise(
 mean_energy_exp = mean(energy_expense),
 median_energy_exp = median(energy_expense),
 sd_energy_exp = sd(energy_expense))
```

```
## `summarise()` has grouped output by 'heat_equip'. You can override using the
## `.groups` argument.
```

```
cas_hftandhe
```

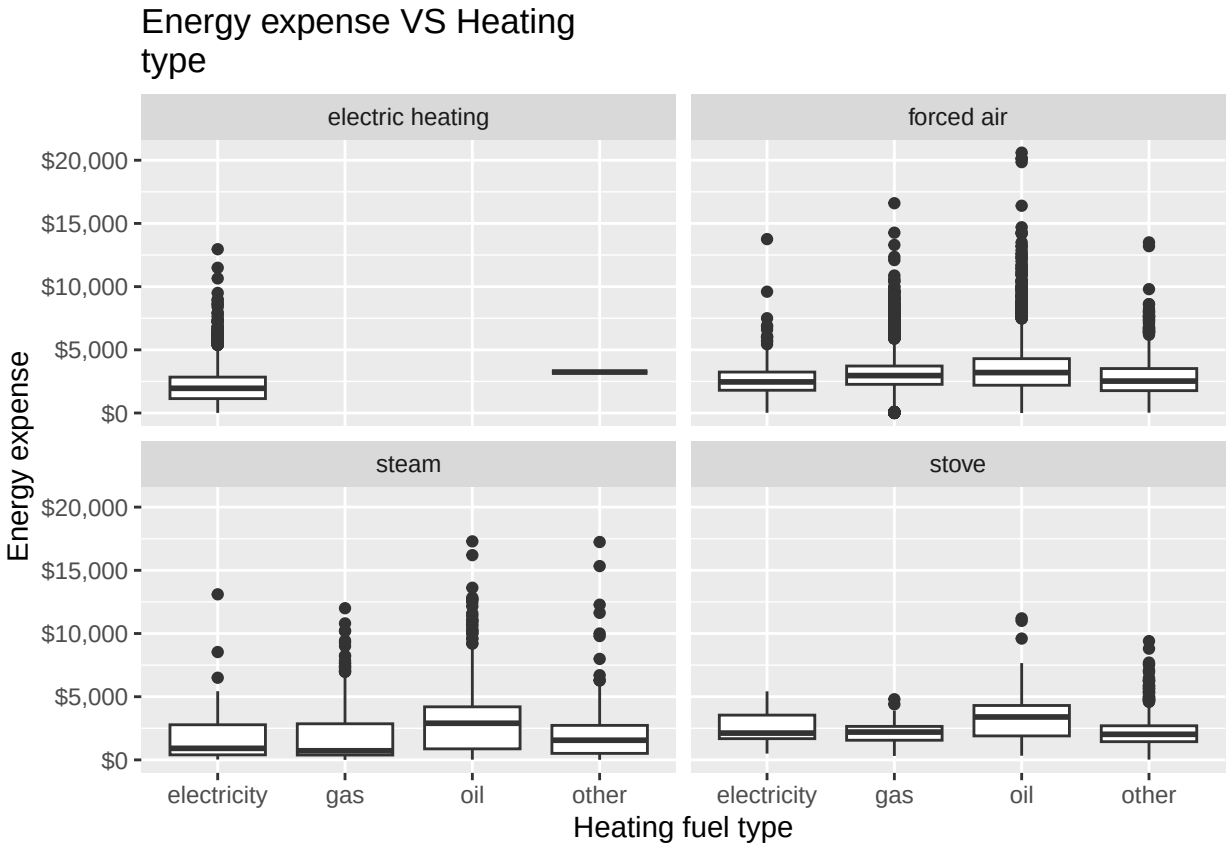
```
## # A tibble: 14 x 5
## # Groups:   heat_equip [4]
##    heat_equip       heat_fuel   mean_energy_exp median_energy_exp sd_energy_exp
##    <chr>            <chr>                 <dbl>             <dbl>         <dbl>
##  1 electric heating electricity          2084.             1956          1270.
##  2 electric heating other                3240              3240            NA
##  3 forced air       electricity          2590.             2462.         1293.
##  4 forced air       gas                  3047.             2960          1395.
##  5 forced air       oil                  3499.             3200          2156.
##  6 forced air       other                2861.             2526          1655.
##  7 steam            electricity          1708.              915          1692.
##  8 steam            gas                  1698.              720          1820.
##  9 steam            oil                  2887.             2900          2142.
## 10 steam            other                2047.             1555          2279.
## 11 stove            electricity          2443.             2120          1229.
## 12 stove            gas                  2178.             2202          1024.
## 13 stove            oil                  3396.             3395          2074.
## 14 stove            other                2210.             2025          1140.
```

- Provide the answer to the theoretical questions here

1.The combination of fuel type and equipment with the highest average energy expense is "forced air-oil" with a mean energy expense of 3498.850. 2.The combination with the most variability with regards to energy expense is "forced air-oil" as indicated by the highest standard deviation of 2155.709. 3.The heating equipment type that doesn't take all possible fuel types is "electric heating" as it only uses electricity and "other" fuel types, while the other heating equipment types (forced air and steam) can use electricity, gas, oil, and other fuel types.

Task 4

```
ggplot(cas, mapping = aes(x=heat_fuel, y=energy_expense)) + geom_boxplot() +
 scale_y_continuous(labels = scales::dollar_format()) +
 facet_wrap(~ heat_equip, nrow = 2) + labs(title="Energy expense VS Heating
type", x="Heating fuel type", y="Energy expense")
```



Task 5

```
proportion<-cas %>% mutate(energy_prop = energy_expense / household_income) %>%
 arrange(desc(energy_prop)) %>%
 slice(1, n()) %>%
 glimpse()
```

```
## Rows: 2
## Columns: 25
## $ year                <fct> 2009, 2009
## $ province            <fct> Saskatchewan, Ontario
## $ dwelling_type       <fct> "Single detached", "Apartment"
## $ year_built          <fct> 1971-1980, 1971-1980
## $ rooms               <dbl> 7, 6
## $ beds                <dbl> 3, 2
## $ baths               <dbl> 1, 1
## $ heat_equip          <chr> "forced air", "forced air"
## $ heat_age            <fct> 2, 5
## $ heat_fuel           <chr> "gas", "gas"
## $ water_fuel          <fct> 2, 4
## $ cook_fuel           <fct> 2, 2
## $ income              <dbl> 100, 67000
## $ marital_status      <fct> 3, 3
```

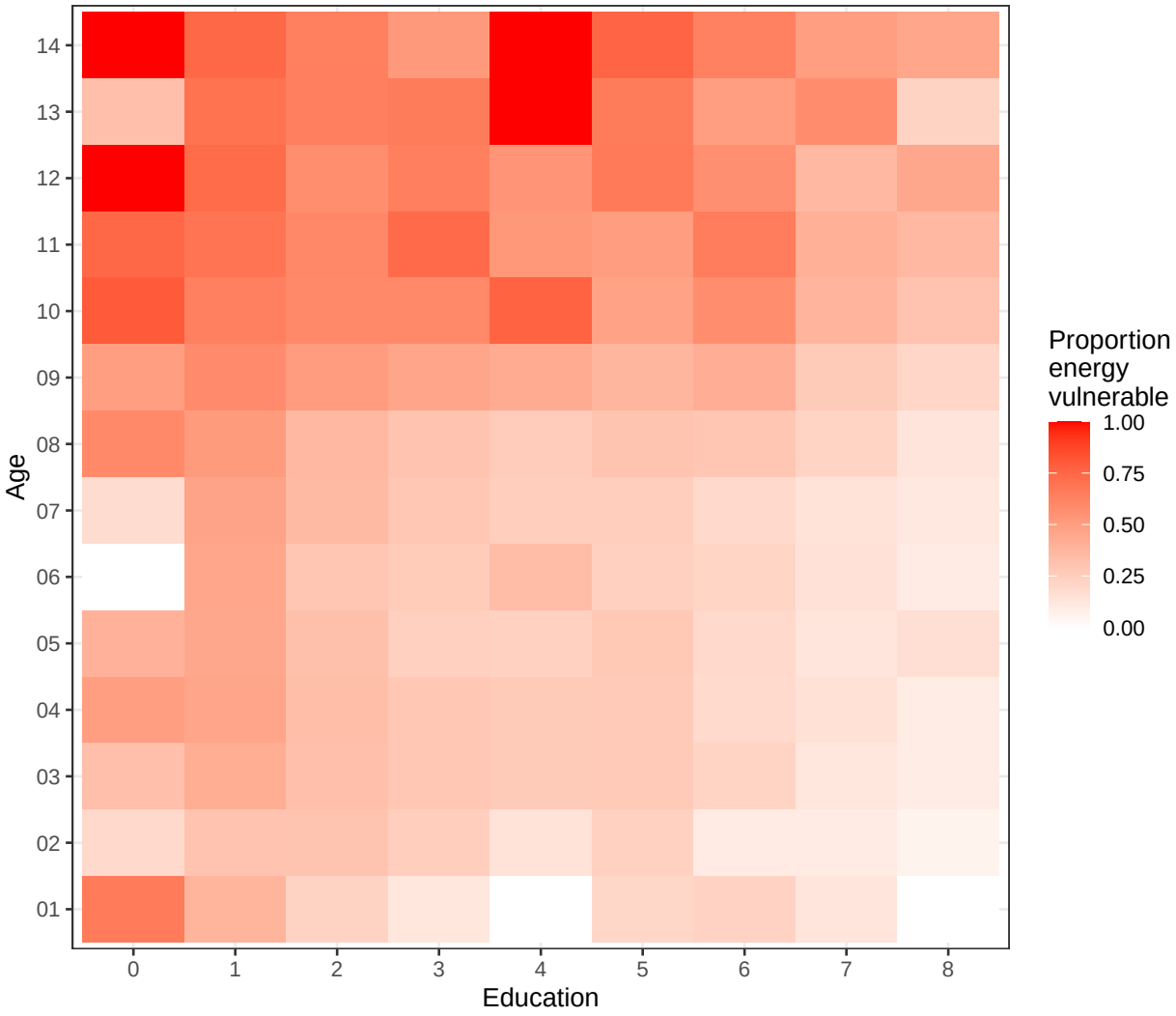
```
## $ age                 <fct> 08, 14
## $ sex                 <fct> 2, 2
## $ education           <fct> 6, 1
## $ household_income    <dbl> 100, 67000
## $ energy_expense      <dbl> 3780, 1
## $ water_expense       <dbl> 540, 1
## $ electricity_expense <dbl> 1716, 0
## $ nat_gas_expense     <dbl> 1524, 0
## $ other_fuel_expense  <dbl> 0, 0
## $ consumption         <dbl> 19908, 16423
## $ energy_prop         <dbl> 3.780000e+01, 1.492537e-05
```

Task 6

```
province<-cas %>% mutate(eepr = energy_expense / rooms) %>%
 group_by(year, province) %>%
 summarise(median_energy_expense_per_room = median(eepr)) %>%
 arrange(median_energy_expense_per_room) %>%
 slice(1) %>%
 ungroup()
```

Task 7

```
cas %>% mutate(energy_prop = energy_expense / household_income,
 vulnerable = if_else(energy_prop > 0.05, "vulnerable", "not")) %>%
 group_by(education, age) %>%
 summarize(prop_vulnerable = mean(vulnerable == "vulnerable")) %>%
 ungroup() %>%
 ggplot(aes(x = education, y = age, fill = prop_vulnerable)) +
 geom_raster() +
 scale_fill_gradient(low = "white", high = "red") +
 labs(x = "Education", y = "Age", fill = "Proportion\nenergy\nvulnerable") +
 theme_bw()
```


Age
14
13
12
11
10
09
08
07
06
05
04
03
02
01
0
1
2
3
4
5
6
7
8
Education
Proportion energy vulnerable
1.00
0.75
0.50
0.25
0.00