Midterm 2

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Read in the data

```
library(tidyverse)
library(tidymodels)
library(car)
library(dplyr)
library(stats)

beijing <- read_csv("beijing_mod.csv")
```

Exercise 2

```
m1 <- lm(SO2 ~ as.factor(season) + TEMP + PRES + TEMP * PRES, data = beijing)
summary(m1)
```

```
Call:
lm(formula = SO2 ~ as.factor(season) + TEMP + PRES + TEMP * PRES,
    data = beijing)

Residuals:
    Min      1Q  Median      3Q     Max
-35.781 -10.622  -4.016   4.616 174.295

Coefficients:
                          Estimate Std. Error t value Pr(>|t|)
(Intercept)             784.398352  91.394715   8.583  < 2e-16 ***
as.factor(season)spring   8.759455   1.216483   7.201  7.9e-13 ***
as.factor(season)summer  -0.943552   1.665693  -0.566  0.57113
```

```
as.factor(season)winter  16.785910   1.502738  11.170  < 2e-16 ***
TEMP                    -13.537241   4.769535  -2.838  0.00457 **
PRES                     -0.753995   0.089570  -8.418  < 2e-16 ***
TEMP:PRES                 0.012671   0.004719   2.685  0.00730 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 20.35 on 2493 degrees of freedom
Multiple R-squared:  0.2047,    Adjusted R-squared:  0.2028
F-statistic:   107 on 6 and 2493 DF,  p-value: < 2.2e-16
```

Exercise 3

```r
beijing2 <- beijing %>%
  mutate(precipitation = ifelse(RAIN == 0.0,
    "No", "Yes"))

beijing2$season <- factor(beijing2$season, ordered = FALSE)
beijing2$season <- relevel(beijing2$season, ref = "summer")
m2 <- lm(log10(SO2) ~ as.factor(season) + TEMP + log2(WSPM) + as.factor(precipitation) + P
summary(m2)
```

```
Call:
lm(formula = log10(SO2) ~ as.factor(season) + TEMP + log2(WSPM) +
    as.factor(precipitation) + PRES + log2(WSPM) * as.factor(season),
    data = beijing2)

Residuals:
     Min       1Q   Median       3Q      Max
-1.23432 -0.32775 -0.03669  0.29638  1.31372

Coefficients:
                                  Estimate Std. Error t value Pr(>|t|)
(Intercept)                       9.851037   1.664656   5.918 3.71e-09 ***
as.factor(season)fall             0.163113   0.033698   4.840 1.38e-06 ***
as.factor(season)spring           0.510918   0.034364  14.868  < 2e-16 ***
as.factor(season)winter           0.792829   0.046127  17.188  < 2e-16 ***
TEMP                             -0.009499   0.001738  -5.466 5.06e-08 ***
log2(WSPM)                        0.077800   0.021471   3.623 0.000297 ***
as.factor(precipitation)Yes      -0.297062   0.043791  -6.784 1.46e-11 ***
```

```
PRES                                -0.009015   0.001636  -5.510 3.95e-08 ***
as.factor(season)fall:log2(WSPM)    -0.071168   0.026180  -2.718 0.006606 **
as.factor(season)spring:log2(WSPM) -0.166037   0.026834  -6.188 7.12e-10 ***
as.factor(season)winter:log2(WSPM) -0.310816   0.027126 -11.458  < 2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.4201 on 2489 degrees of freedom
Multiple R-squared:  0.341, Adjusted R-squared:  0.3384
F-statistic: 128.8 on 10 and 2489 DF,  p-value: < 2.2e-16
```

Exercise 4

```
10 ^ (-0.012)
```

```
[1] 0.9727472
```

```
10 ^ 0.735
```

```
[1] 5.432503
```

```
10 ^ 0.074
```

```
[1] 1.185769
```

```
10 ^ (0.074 - 0.049)
```

```
[1] 1.059254
```

```
10 ^ (0.074 - 0.245)
```

```
[1] 0.674528
```

```
10 ^ (0.074 - 0.146)
```

```
[1] 0.8472274
```

Summer: log10(SO2) = intercept + 0.074log2(WSPM) Fall: log10(SO2) = intercept + 0.074log2(WSPM) - 0.049log2(WSPM) = intercept + 0.025log2(WSPM) Winter: log10(SO2) = intercept + 0.074log2(WSPM) - 0.245log2(WSPM) = intercept - 0.171log2(WSPM) Spring: log10(SO2) = intercept + 0.074log2(WSPM) - 0.146log2(WSPM) = intercept - 0.072log2(WSPM)