

## PSTAT126-lab5

```
library(alr4)
```

```
## Warning: package 'alr4' was built under R version 4.1.3
## Loading required package: car
## Warning: package 'car' was built under R version 4.1.3
## Loading required package: carData
## Warning: package 'carData' was built under R version 4.1.3
## Loading required package: effects
## Warning: package 'effects' was built under R version 4.1.3
## lattice theme set by effectsTheme()
## See ?effectsTheme for details.
```

```
library(car)
```

```
#United Nation Data
```

```
# lifeExpF: Female life expectancy, years
# ppgdp: Per capita gross domestic product in US dollars
# fertility: number of children per woman
head(UN11)
```

	region	group	fertility	ppgdp	lifeExpF	pctUrban
## Afghanistan	Asia	other	5.968	499.0	49.49	23
## Albania	Europe	other	1.525	3677.2	80.40	53
## Algeria	Africa	africa	2.142	4473.0	75.00	67
## Angola	Africa	africa	5.135	4321.9	53.17	59
## Anguilla	Caribbean	other	2.000	13750.1	81.10	100
## Argentina	Latin Amer	other	2.172	9162.1	79.89	93

### ANOVA and F test

```
# P134 F test
# P137,140 example
fit1 <- lm(lifeExpF ~ group + log(ppgdp) + group:log(ppgdp), data=UN11)
fit2 <- lm(lifeExpF ~ group + log(ppgdp), data=UN11)
fit3 <- lm(lifeExpF ~ group, data=UN11)
fit4 <- lm(lifeExpF ~ log(ppgdp), data=UN11)
anova(fit2, fit1)
```

```
## Analysis of Variance Table
```

```
##
```

```
## Model 1: lifeExpF ~ group + log(ppgdp)
```

```
## Model 2: lifeExpF ~ group + log(ppgdp) + group:log(ppgdp)
```

```
##   Res.Df    RSS Df Sum of Sq    F Pr(>F)
```

```
## 1      195 5090.4
```

```
## 2      193 5077.7  2      12.675 0.2409 0.7862
anova(fit3, fit2)

## Analysis of Variance Table
##
## Model 1: lifeExpF ~ group
## Model 2: lifeExpF ~ group + log(ppgdp)
##   Res.Df    RSS Df Sum of Sq      F    Pr(>F)
## 1      196 7730.2
## 2      195 5090.4  1      2639.8 101.12 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

anova(fit4, fit2)

## Analysis of Variance Table
##
## Model 1: lifeExpF ~ log(ppgdp)
## Model 2: lifeExpF ~ group + log(ppgdp)
##   Res.Df    RSS Df Sum of Sq      F    Pr(>F)
## 1      197 8190.7
## 2      195 5090.4  2      3100.3 59.383 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

# type one/sequential ANOVA
fit_aov <- aov(lifeExpF ~ group + log(ppgdp) + group:log(ppgdp), data=UN11)
summary(fit_aov)

##              Df Sum Sq Mean Sq F value Pr(>F)
## group          2  12563    6282 238.756 <2e-16 ***
## log(ppgdp)      1   2640    2640 100.338 <2e-16 ***
## group:log(ppgdp) 2     13         6   0.241  0.786
## Residuals      193   5078         26
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

nrow(UN11)

## [1] 199
```