Week 7: Mixed Models

MATH-516 Applied Statistics

Tomas Masak

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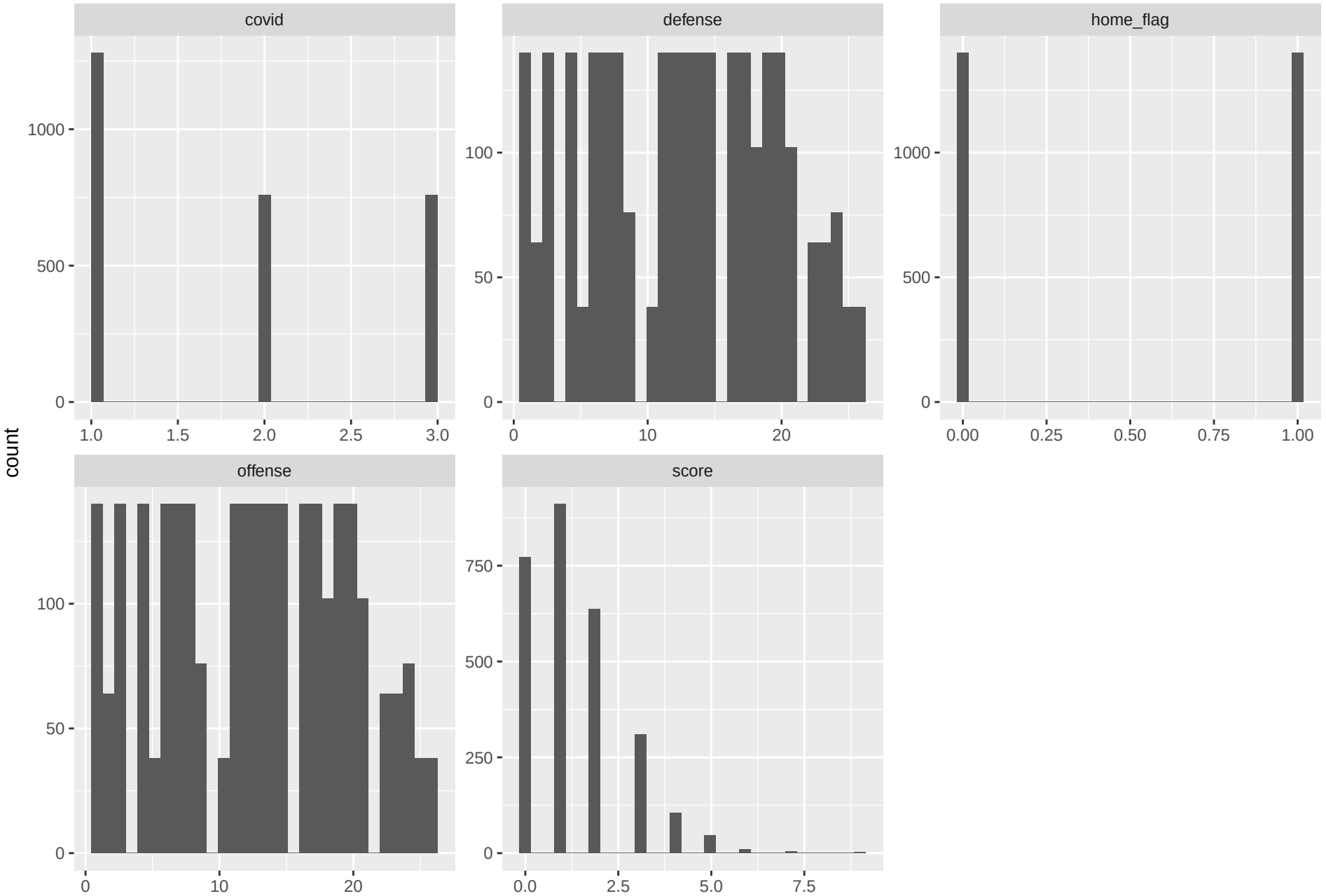
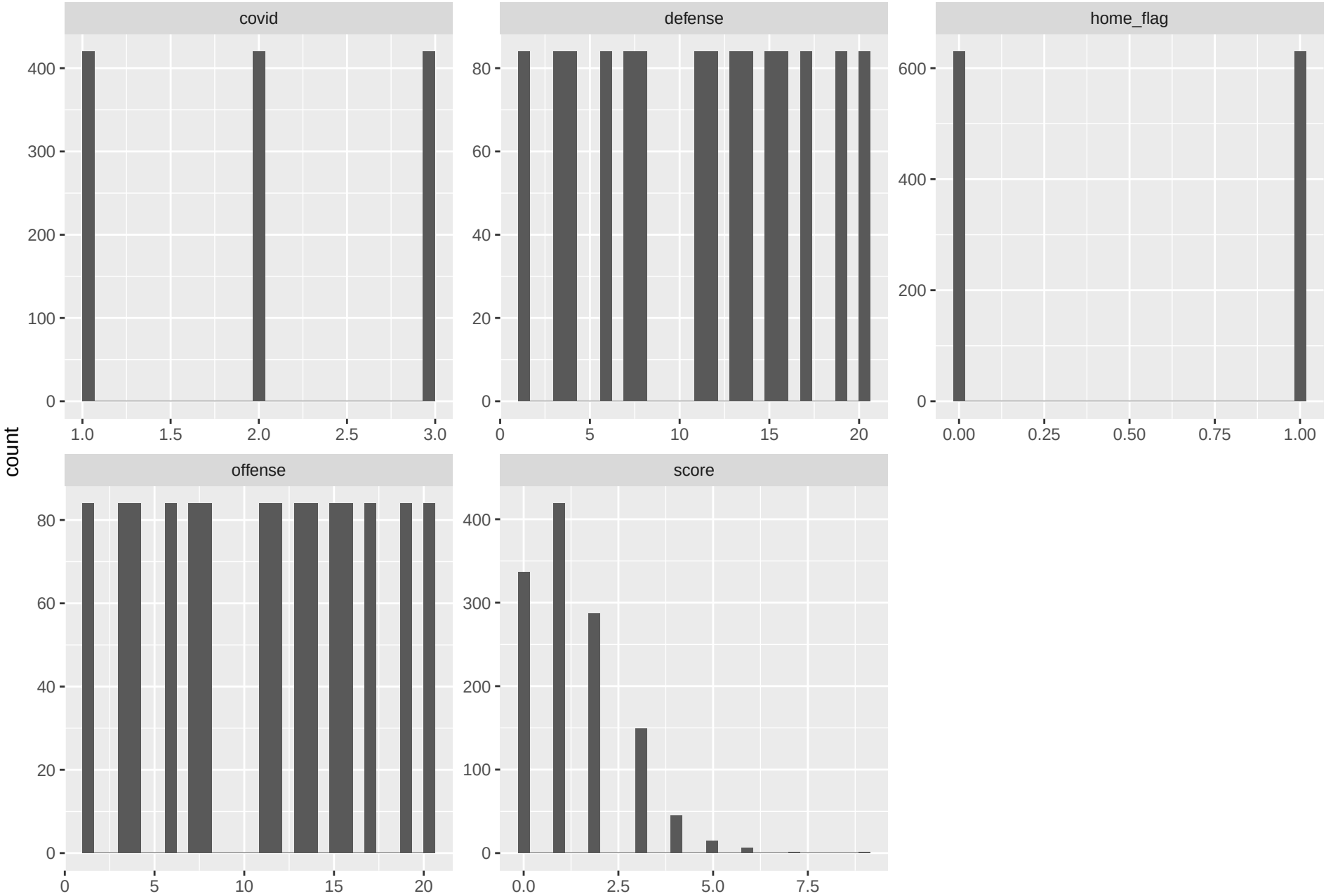
Section 1

Project 3: Premier League

Data Visualized



Balanced Data



Models (Balanced Data)

```
m <- glm(score~covid*home_flag+defense+offense, data=subDat, family="poisson")
msub <- glm(score~home_flag+defense+offense, data=subDat, family="poisson")
anova(m,msub,test="LRT")
```

```
## Analysis of Deviance Table
##
## Model 1: score ~ covid * home_flag + defense + offense
## Model 2: score ~ home_flag + defense + offense
##   Resid. Df Resid. Dev Df Deviance Pr(>Chi)
## 1      1226     1352.8
## 2      1230     1357.5 -4  -4.7254   0.3167
```

Models (Full Data)

```
m <- glm(score~covid*(home_flag+defense+offense), data=Data, family="poisson")
msub <- glm(score~home_flag+defense+offense, data=Data, family="poisson")
anova(m,msub,test="LRT")
```

```
## Analysis of Deviance Table
##
## Model 1: score ~ covid * (home_flag + defense + offense)
## Model 2: score ~ home_flag + defense + offense
##   Resid. Df Resid. Dev  Df Deviance Pr(>Chi)
## 1      2674     2952.6
## 2      2748     3057.7 -74  -105.14   0.0101 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
library(car)
Anova(m,type=2)
```

```
## Analysis of Deviance Table (Type II tests)
##
## Response: score
##                 LR Chisq Df Pr(>Chisq)
## covid               0.91  2   0.633917
## home_flag          16.99  1  3.761e-05 ***
## defense           184.35 25  < 2.2e-16 ***
## offense           345.44 25  < 2.2e-16 ***
## covid:home_flag     5.77  2   0.055895 .
## covid:defense      60.04 35   0.005292 **
## covid:offense      36.35 35   0.405718
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Models (Full Data)

```
minter <- glm(score~covid*(home_flag+defense)+offense, data=Data, family="poisson")
msub <- glm(score~home_flag+covid*defense+offense, data=Data, family="poisson")
anova(m,msub,test="LRT")
```

```
## Analysis of Deviance Table
##
## Model 1: score ~ covid * (home_flag + defense + offense)
## Model 2: score ~ home_flag + covid * defense + offense
##   Resid. Df Resid. Dev  Df Deviance Pr(>Chi)
## 1      2674     2952.6
## 2      2711     2994.7 -37  -42.102   0.2596
```

```
anova(minter,msub,test="LRT")
```

```
## Analysis of Deviance Table
##
## Model 1: score ~ covid * (home_flag + defense) + offense
## Model 2: score ~ home_flag + covid * defense + offense
##   Resid. Df Resid. Dev Df Deviance Pr(>Chi)
## 1      2709     2988.9
## 2      2711     2994.7 -2  -5.7544  0.05629 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
sum(is.na(coefficients(m)))
```

```
## [1] 30
```

- we are on the edge of significance with a model that has too few observations to rely on asymptotics and to estimate all the parameters

A GLMM

```
library(lme4)
m <-  glmer(score ~ covid*home_flag+(1|defense/covid)+(1|offense),
            data=Data, family="poisson")
msub <-  glmer(score ~ covid*home_flag+(1|defense)+(1|offense),
               data=Data, family="poisson")
```

- is `m` a good model?
- can it be simplified to `msub`?
- in both `m` and `msub`, the `covid:home_flag` interaction *looks* significant
  - home advantage reduced during covid and bounced back after covid (not to the original level, but the difference not significant)

Common Feedback to Reports

- describe data you use, not data you were given
  - (nobody cares whether you got 4 csv files or a single one, and which variables were available but never used because they have absolutely nothing to do with anything, like the betting odds)
- there are some reserved words in statistics such as "significant" or "robust" that are better paraphrased when not used in the reserved meaning (statistical testing, robustness against outliers)
- multiple models vs. a single model
- not taking into account which teams are playing leads to dependence between data
- not including the intercept (i.e. manually discarding the intercept) is problematic since more parameters become inconsistent
  - Poisson vs. multinomial likelihoods
  - it is never a good idea to discard the intercept!
- doesn't vs. does not; let's vs. let us
- description of pre-processing your data (e.g. every match coded twice)

Section 2

Common Feedback to Code by Charles

General comments

Overall good code, just a few remarks:

Major:

- variable names should be descriptive: `data`, `data2` → `raw_data`, `clean_data`
- Code style (see next slides)
- Colors (see next slides)

Minor:

- commit messages: should describe work done by the commit (`ahhhhh` might reflect how you feel at the time of commit, but it's not very informative)

Code style

Code spacing and linting are important https://style.tidyverse.org/

```
# Good
do_something_very_complicated(
  something = "that",
  requires = many,
  arguments = "some of which may be long"
)

# Bad
do_something_very_complicated("that", requires, many, arguments,
                              "some of which may be long"
                              )
```

Color palette

- understand color scheme selection: https://www.gastonsanchez.com/
- use preset palettes:

```
library(RColorBrewer)
par(mfrow=c(1,2))
display.brewer.pal(name = "Blues", n = 4)
display.brewer.pal(name = "Set1", n = 4)
```

Blues (sequential)

Set1 (qualitative)