Code ▾

MATH2349 Semester 2, 2018

Assignment 2

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Setup

Install and load the necessary packages to reproduce the report here:

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```
# Loading all the required packages
library(readr)
library(tidyr)
library(dplyr)
library(Hmisc)
library(outliers)
library(DescTools)
library(kableExtra)
library(mosaic)
```

Import the WHO data

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```
who <- read_csv("Who.csv")
kable(head(who[,1:5])) %>%
  kable_styling(bootstrap_options = c("striped", "hover"))
```

country	iso2	iso3	year	new_sp_m014
Afghanistan	AF	AFG	1980	NA
Afghanistan	AF	AFG	1981	NA
Afghanistan	AF	AFG	1982	NA
Afghanistan	AF	AFG	1983	NA
Afghanistan	AF	AFG	1984	NA
Afghanistan	AF	AFG	1985	NA

Note: all code the same

Tidy Task 1:

Use tidyr functions to reshape/ gather the WHO data

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```
who_tidy1 <- who %>% gather(code, value, 5:length(who))
kable(head(who_tidy1)) %>%
  kable_styling(bootstrap_options = c("striped", "hover"))
```

country	iso2	iso3	year	code	value
Afghanistan	AF	AFG	1980	new_sp_m014	NA
Afghanistan	AF	AFG	1981	new_sp_m014	NA
Afghanistan	AF	AFG	1982	new_sp_m014	NA
Afghanistan	AF	AFG	1983	new_sp_m014	NA
Afghanistan	AF	AFG	1984	new_sp_m014	NA
Afghanistan	AF	AFG	1985	new_sp_m014	NA

Note: Sam’s code

Tidy Task 2:

Splitting/ separating the code column to get closer to tidy data

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```
who_tidy2 <- who_tidy1 %>%
  separate(code, c("new", "var", "sex"), sep = "_") %>%
  separate(sex, c("sex", "age"), sep = 1)
kable(head(who_tidy2)) %>%
  kable_styling(bootstrap_options = c("striped", "hover"))
```

country	iso2	iso3	year	new	var	sex	age	value
Afghanistan	AF	AFG	1980	new	sp	m	014	NA
Afghanistan	AF	AFG	1981	new	sp	m	014	NA
Afghanistan	AF	AFG	1982	new	sp	m	014	NA
Afghanistan	AF	AFG	1983	new	sp	m	014	NA
Afghanistan	AF	AFG	1984	new	sp	m	014	NA
Afghanistan	AF	AFG	1985	new	sp	m	014	NA

Note: Verity’s code

Tidy Task 3:

Spreading the data to get it into a tidy format

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```
who_tidy3 <- who_tidy2 %>% spread(var, value)
kable(head(who_tidy3)) %>%
  kable_styling(bootstrap_options = c("striped", "hover"))
```

country	iso2	iso3	year	new	sex	age	ep	rel	sn	sp
Afghanistan	AF	AFG	1980	new	m	014	NA	NA	NA	NA

country	iso2	iso3	year	new	sex	age	ep	rel	sn	sp
Afghanistan	AF	AFG	1981	new	m	014	NA	NA	NA	NA
Afghanistan	AF	AFG	1982	new	m	014	NA	NA	NA	NA
Afghanistan	AF	AFG	1983	new	m	014	NA	NA	NA	NA
Afghanistan	AF	AFG	1984	new	m	014	NA	NA	NA	NA
Afghanistan	AF	AFG	1985	new	m	014	NA	NA	NA	NA

Note: all code the same

Tidy Task 4:

Mutating and factorising variables

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```
who_tidy4 <- who_tidy3 %>% mutate(sex = factor(sex, levels = c("m", "f"), labels = c("m", "f")),
                                  age = factor(age, levels = c("014", "1524", "2534", "3544", "4554",
"5564", "65"),
                                               labels = c("<15", "15-24", "25-34", "35-44", "45-54",
"55-64", "65>="),
                                               ordered = TRUE))
sapply(who_tidy4[c("sex", "age")], class)
```

```
$sex
[1] "factor"

$age
[1] "ordered" "factor"
```

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```
kable(head(who_tidy4)) %>%
  kable_styling(bootstrap_options = c("striped", "hover"))
```

country	iso2	iso3	year	new	sex	age	ep	rel	sn	sp
Afghanistan	AF	AFG	1980	new	m	<15	NA	NA	NA	NA
Afghanistan	AF	AFG	1981	new	m	<15	NA	NA	NA	NA
Afghanistan	AF	AFG	1982	new	m	<15	NA	NA	NA	NA
Afghanistan	AF	AFG	1983	new	m	<15	NA	NA	NA	NA
Afghanistan	AF	AFG	1984	new	m	<15	NA	NA	NA	NA
Afghanistan	AF	AFG	1985	new	m	<15	NA	NA	NA	NA

Note: Meg’s code

Task 5: Filter & Select

Filtering and selecting the WHO data

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```
countries <- c("Fiji", "Germany", "Korea")
who_subset <- who_tidy4 %>% select(-c(2, 5)) %>%
  filter(country %in% countries)
kable(head(who_subset)) %>%
  kable_styling(bootstrap_options = c("striped", "hover"))
```

country	iso3	year	sex	age	ep	rel	sn	sp
Fiji	FJI	1980	m	<15	NA	NA	NA	NA
Fiji	FJI	1981	m	<15	NA	NA	NA	NA
Fiji	FJI	1982	m	<15	NA	NA	NA	NA
Fiji	FJI	1983	m	<15	NA	NA	NA	NA
Fiji	FJI	1984	m	<15	NA	NA	NA	NA
Fiji	FJI	1985	m	<15	NA	NA	NA	NA

Note: Verity’s code

Read Species and Surveys data sets

Importing the species and surveys data

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```
surveys <- read_csv("surveys.csv")
species <- read_csv("species.csv")
kable(head(surveys)) %>%
  kable_styling(bootstrap_options = c("striped", "hover"))
```

record_id	month	day	year	species_id	sex	hindfoot_length	weight
1	7	16	1977	NL	M	32	NA
2	7	16	1977	NL	M	33	NA
3	7	16	1977	DM	F	37	NA
4	7	16	1977	DM	M	36	NA
5	7	16	1977	DM	M	35	NA
6	7	16	1977	PF	M	14	NA

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```
kable(head(species)) %>%
  kable_styling(bootstrap_options = c("striped", "hover"))
```

species_id	genus	species	taxa
AB	Amphispiza	bilineata	Bird

species_id	genus	species	taxa
AH	Ammospermophilus	harrisi	Rodent
AS	Ammodramus	savannarum	Bird
BA	Baiomys	taylori	Rodent
CB	Campylorhynchus	brunneicapillus	Bird
CM	Calamospiza	melanocorys	Bird

Note: all code the same

Task 6: Join

Join the species and surveys data

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```
surveys_combined <- surveys %>% left_join(species[, c("species_id", "genus", "species", "taxa")], by =
 "species_id")
kable(head(surveys_combined)) %>%
  kable_styling(bootstrap_options = c("striped", "hover"))
```

record_id	month	day	year	species_id	sex	hindfoot_length	weight	genus	species	taxa
1	7	16	1977	NL	M	32	NA	Neotoma	albigula	Rodent
2	7	16	1977	NL	M	33	NA	Neotoma	albigula	Rodent
3	7	16	1977	DM	F	37	NA	Dipodomys	merriami	Rodent
4	7	16	1977	DM	M	36	NA	Dipodomys	merriami	Rodent
5	7	16	1977	DM	M	35	NA	Dipodomys	merriami	Rodent
6	7	16	1977	PF	M	14	NA	Perognathus	flavus	Rodent

Note: Verity’s code

Task 7: Calculate

Calculating mean weight and hindfoot lengths

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```
species_avg <- surveys_combined %>% filter(species == "fulviventer") %>%
  group_by(month) %>%
  summarise(mean_weights = mean(weight, na.rm = TRUE),
            mean_foot = mean(hindfoot_length, na.rm = TRUE))
kable(head(species_avg)) %>%
  kable_styling(bootstrap_options = c("striped", "hover"))
```

month	mean_weights	mean_foot
1	48.22222	26.77778

month	mean_weights	mean_foot
2	56.50000	25.75000
3	58.00000	28.66667
4	50.50000	21.00000
5	54.66667	26.00000
6	38.50000	23.00000

Note: mainly Meg’s code Anyone have strong feelings about which species we use???

Task 8: Missing Values

Dealing with missing values through imputing

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```
surveys_combined_year <- surveys_combined %>% filter(year == "1990")
surveys_combined_year %>% group_by(species) %>% summarise(Missing = sum(is.na(weight)))
```

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```
surveys_weight_imputed <- surveys_combined_year %>%  group_by(species) %>% mutate(weight = ifelse(is.na(weight), mean(weight, na.rm = TRUE), weight))
```

Note: Sam’s code Mean year of birth

There are still missing values as there are some entire species that only have NA values for weight in 1990. The means of these species is NaN.

Task 9: Inconsistencies or Special Values

Checking for inconsistencies in the weight data and explaining why they have occurred.

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```
sum(is.nan(surveys_weight_imputed$weight))
```

```
[1] 82
```

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```
example <- first(which(is.na(surveys_weight_imputed$weight)))
species_eg <- surveys_weight_imputed[example,]$species
no_data_species <- filter(surveys_weight_imputed, species == species_eg)
favstats(no_data_species$weight) #Shows that all values for this species are NaN
```

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```
is.special <- function(x){
if (is.numeric(x)) !is.finite(x) else is.na(x)
}
any(sapply(surveys_weight_imputed$weight, is.special))
```

```
[1] TRUE
```

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```
surveys_weight_imputed %>% group_by(species) %>% summarise(Missing = sum(is.na(weight)), Mean = mean(w
eight))
```

Note: combination of code

Explanation: Some species in the data frame have no values available for weight for any observation of that species. When calculating the mean by species, we have excluded NAs so any species with no weight values recorded will have no valid numbers available for calculation. Therefore, the final output includes NaN (not a number) results for the weights of species with no valid weight observation.

Task 10: Outliers

Checking for outliers in the hindfoot length data

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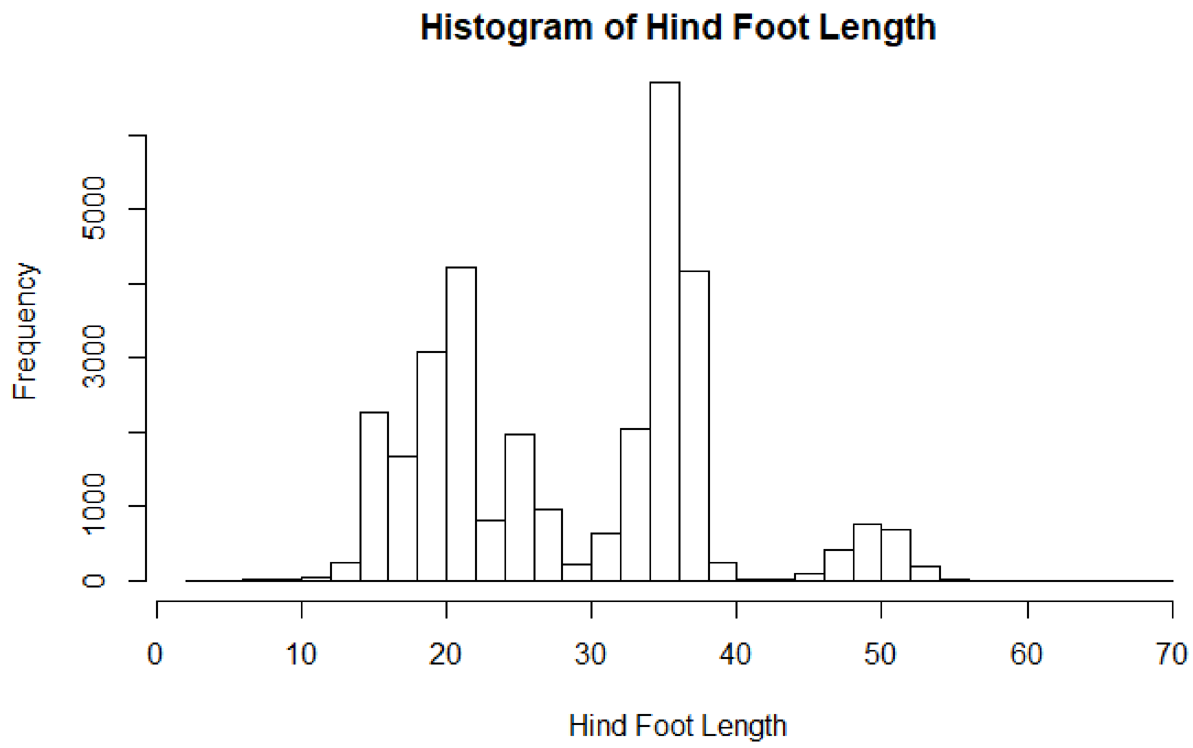
```
hist(surveys_combined$hindfoot_length, breaks = 30,
     main = "Histogram of Hind Foot Length",
     xlab = "Hind Foot Length") #does not seem to be normally distributed
```



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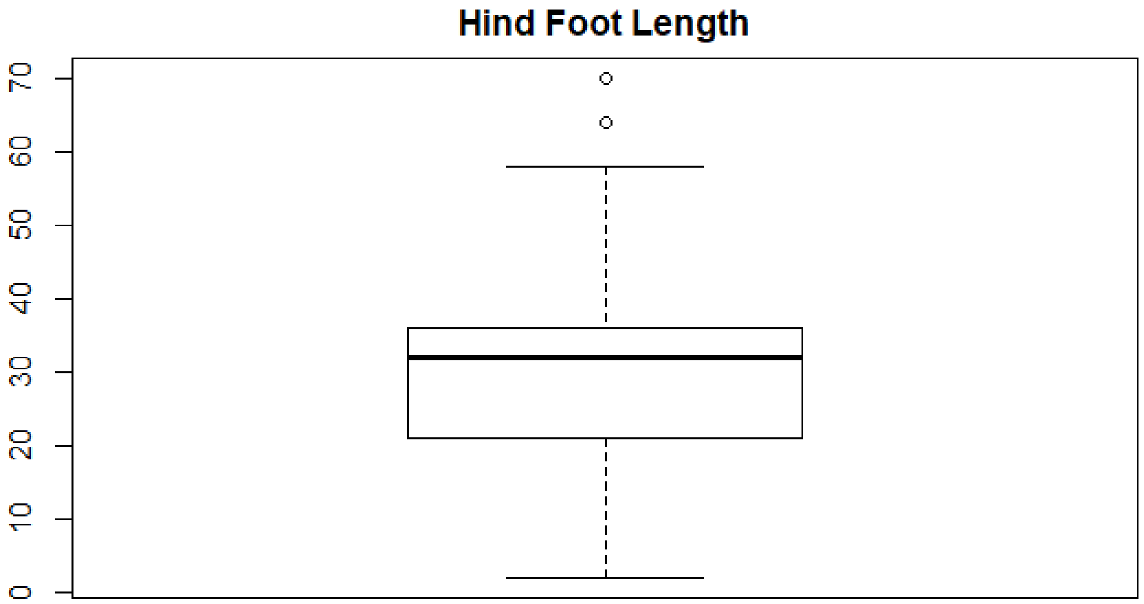
```
x <- boxplot(surveys_combined$hindfoot_length,
             main = "Hind Foot Length") #hence the Tukey method is used
```



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```
x$out
```

```
[1] 70 64
```

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```
IQR(surveys_combined$hindfoot_length, na.rm = TRUE) * 3
```

```
[1] 45
```

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```
# Winsorising the outliers as they don't follow a normal distribution nor are they extreme (neither ex
ceed 3*IQR)
# Winsorising with the Winsorize() function from the DescTools Package
surveys_combined_capped <- Winsorize(surveys_combined$hindfoot_length, na.rm = TRUE)
summary(surveys_combined_capped)
```

```
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.    NA's 
  16.00   21.00   32.00   29.24   36.00   49.00    4111 
```

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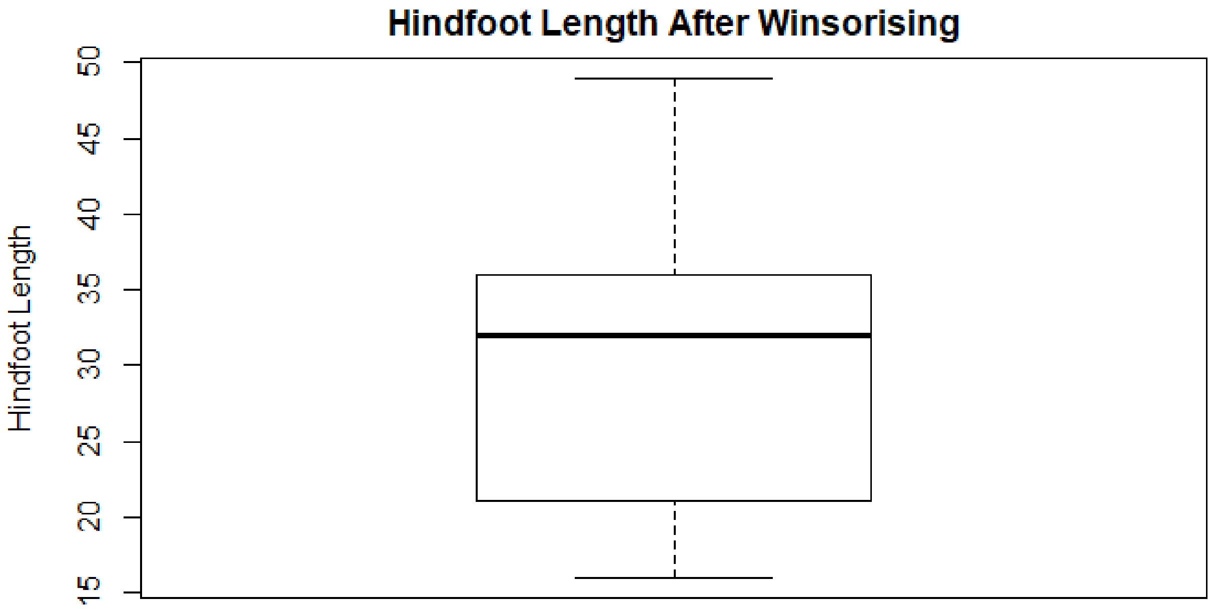
```
boxplot(surveys_combined_capped,
        main = 'Hindfoot Length After Winsorising',
        ylab = 'Hindfoot Length')
```



Note: Sam’s code

The hindfoot length data is not normally distributed. The Tukey method was used to transform the data. We chose to winsorise the outliers as they don’t follow a normal distribution nor are they very extreme.