

Question 1 (<10 min)

Q 1

Suppose an ornithologist is trying to distinguish between 9 species of flycatchers. He measures the relative size of the wing length to the tail length as a way to distinguish the species. The following table shows the average wing length minus the tail length for 24 birds in each species. Why can we not make a conclusion based on the averages alone?

Species	Yellow-Bellied	Acadian	Alder	Willow	Least	Gray	Dusky	Pacific Slope	Cordilleran
Wing-tail	13.6	15.4	14.7	12.4	9.2	13.7	10.3	7.0	9.5

Select one:

- ☐ a. There is no measure of variability within groups given.



Question 2 (< 10 min)

Q 2

Four methods of growing wheat are to be compared on five farms. Four plots are used on each farm and each method is applied to one of the plots. Five measurements are therefore obtained on yield per acre for each of the four growing methods. Is one-way ANOVA an appropriate method for analyzing these results?

Select one:

- ☐ a. No. There are not enough measurements for each method.



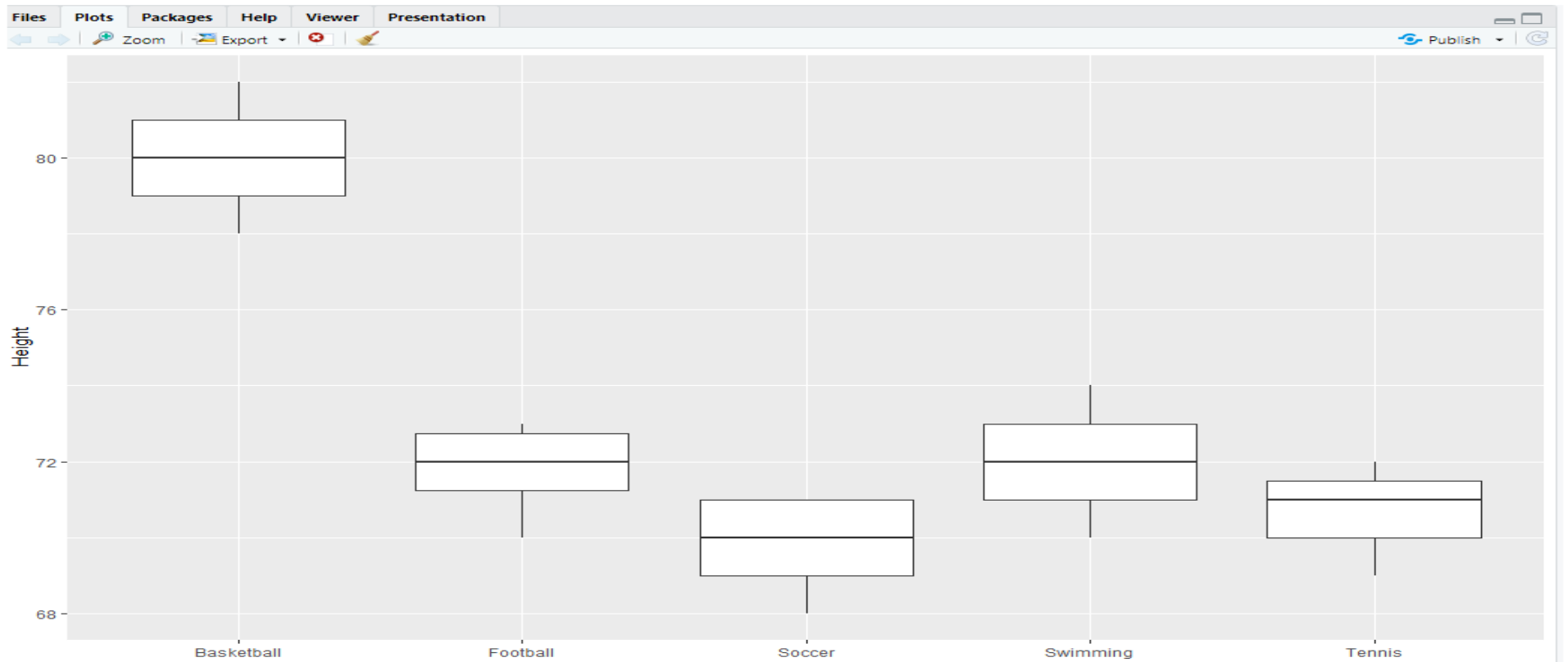
Height

```
Console Terminal x Background Jobs x
R 4.3.1 ~ /

>
> data <- data.frame(
+   Height = c(70, 69, 71, 71, 69, 68, 70, 70, 71, 80, 79, 81, 82, 78, 70, 71, 72, 73, 72, 73, 70, 71, 72, 71, 73, 71, 72, 73, 74, 69, 72, 71),
+   Sport = c(rep("Soccer", 9), rep("Basketball", 5), rep("Football", 6), rep("Swimming", 9), rep("Tennis", 3)),
+   Combine = c(rep("others", 27), rep("Basketball", 5))
+ )
>
> result_combined <- aov(Height ~ Combine, data=data)
> summary(result_combined)
          Df Sum Sq Mean Sq F value Pr(>F)
Combine    1    2.7    2.65   0.199  0.659
Residuals 30 399.3   13.31
>
> drop1(result_combined, test="F")
Single term deletions

Model:
Height ~ Combine
          Df Sum of Sq    RSS   AIC F value Pr(>F)
<none>                 399.32 84.769
Combine  1    2.6502 401.97 82.980  0.1991 0.6586
> |
```

Height



Height

The ANOVA Procedure

Class Level Information		
Class	Levels	Values
Sport	5	Basketball Football Soccer Swimming Tennis

Number of Observations Read	32
Number of Observations Used	32

The ANOVA Procedure

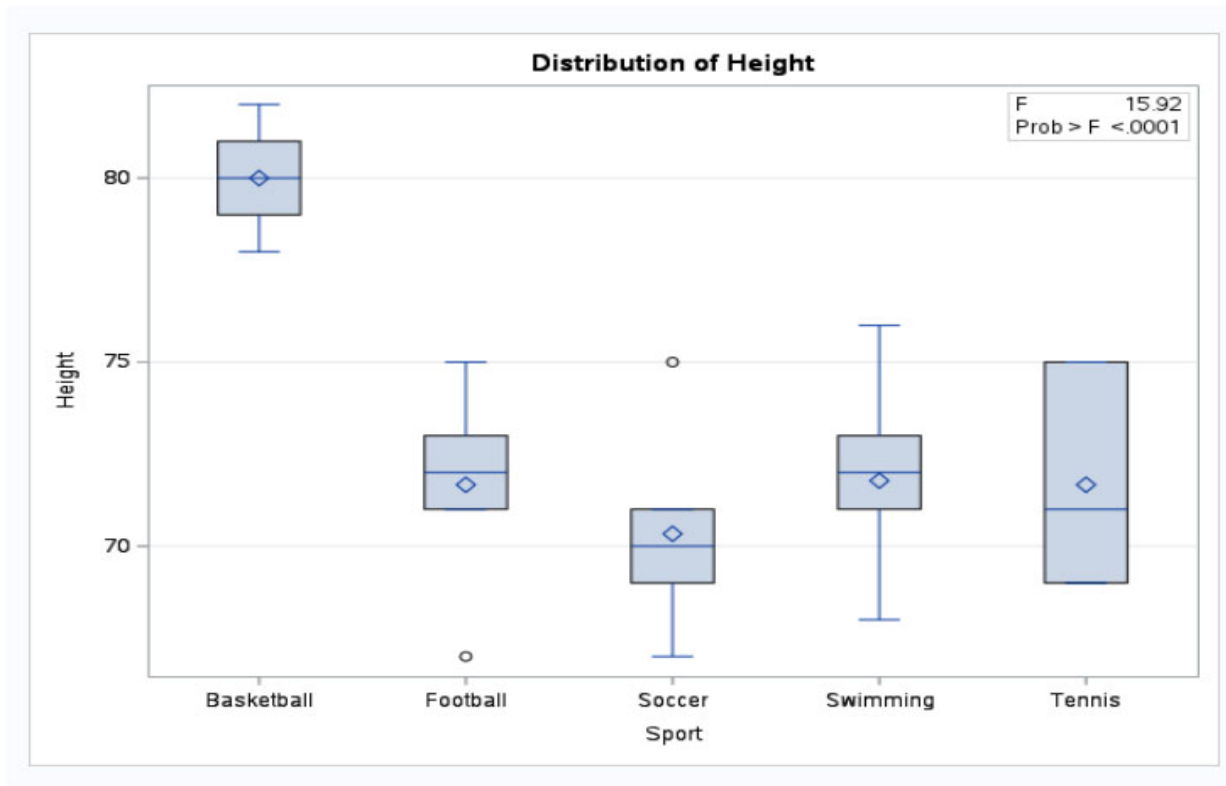
Dependent Variable: Height

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	333.9444444	83.4861111	15.92	<.0001
Error	27	141.5555556	5.2427984		
Corrected Total	31	475.5000000			

R-Square	Coeff Var	Root MSE	Height Mean
0.702302	3.152793	2.289716	72.62500

Source	DF	Anova SS	Mean Square	F Value	Pr > F
Sport	4	333.9444444	83.4861111	15.92	<.0001

Height



End Question 2
