Professor's Notes About 2-Way ANOVA Homework 2

- The key is to construct a table of means similar to Table 1. Then $SS_{instructor}$, SS_{method} and SS_{among} are computed by following the SS_{row}, SS_{column} and SS_{among} formulas from the book. The $SS_{interaction}$ is then found from these SS and SS_{total} by subtraction. All degrees-of-freedom are found by formulae in the book and realizing that $r = 2$, $c = 2$ and $n = 25$. The MS, F, and p-values are found as usual.

Table 1. Means table for learning methods data.

	Lecture	Self	mean
A	75.45	83.98	79.72
B	74.46	80.70	77.58
mean	74.95	82.34	78.65

ANOVA Table

Results shown in Table 2. R code to make calculations are shown in an appendix (note, however, that you are not expected to make these calculations in R).

Table 2. Completed analysis of variance table for learning methods data.

	df	SS	MS	F	p
Among	3	1510.2	503.4	2.58	0.0579
Instructor	1	114.0	114.0	0.58	0.4464
Method	1	1363.5	1363.5	6.99	0.0096
Interaction	1	32.8	32.8	0.17	0.6827
Within	96	18717.1	195.0		
Total	99	20227.3			

R Appendix

```
tmns <- matrix(c(75.45,83.98,74.46,80.70),byrow=TRUE,nrow=2)
colnames(tmns) <- c("Lecture","Self")
rownames(tmns) <- c("A","B")
mns <- addmargins(tmns,FUN=mean)
r <- c <- 2
n <- 25
ssins <- r*n*sum((mns[1:2,3]-mns[3,3])^2)
ssmeth <- r*n*sum((mns[3,1:2]-mns[3,3])^2)
ssamong <- n*sum((mns[1:2,1:2]-mns[3,3])^2)
ssint <- ssamong-ssins-ssmeth
sstotal <- 20227.3
sswithin <- sstotal-ssamong
dfamong <- r*c-1
dfins <- r-1
dfmeth <- c-1
dfint <- dfamong-dfins-dfmeth
dftotal <- r*c*n-1
dfwithin <- dftotal-dfamong
ss <- c(ssamong,ssins,ssmeth,ssint,sswithin)
df <- c(dfamong,dfins,dfmeth,dfint,dfwithin)
ms <- ss/df
f <- ms[-length(ms)]/ms[length(ms)]
p <- pf(f,df1=df[-length(df)],df2=df[length(df)],lower.tail=FALSE)
tbl <- cbind(c(df,dftotal),c(ss,sstotal),c(ms,NA),c(f,NA,NA),c(p,NA,NA))
colnames(tbl) <- c("df","SS","MS","F","p")
rownames(tbl) <- c("Among","Instructor","Method","Interaction","Within","Total")
tbl
```