PSTAT 122 - HW4

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5.12 An experiment is conducted to study the influence of operating temperature and three types of faceplate glass in the light output of an oscilloscope tube. The following data are collected:

Glass Type	Temperature		
	100	125	150
1			
	580	1090	1392
	568	1087	1389
	570	1085	1386
2			
	550	1070	1328
	530	1035	1312
	579	1000	1299

(a) Use $\alpha = 0.05$ in the analysis. Is there a significant interaction effect? Does glass type or temperature affect the response? What conclusions can you draw?

Sol. $H_0 : (\tau\beta)_{ij} = 0$ for all i, j vs. H_1: at least one $(\tau\beta)_{ij} \neq 0$

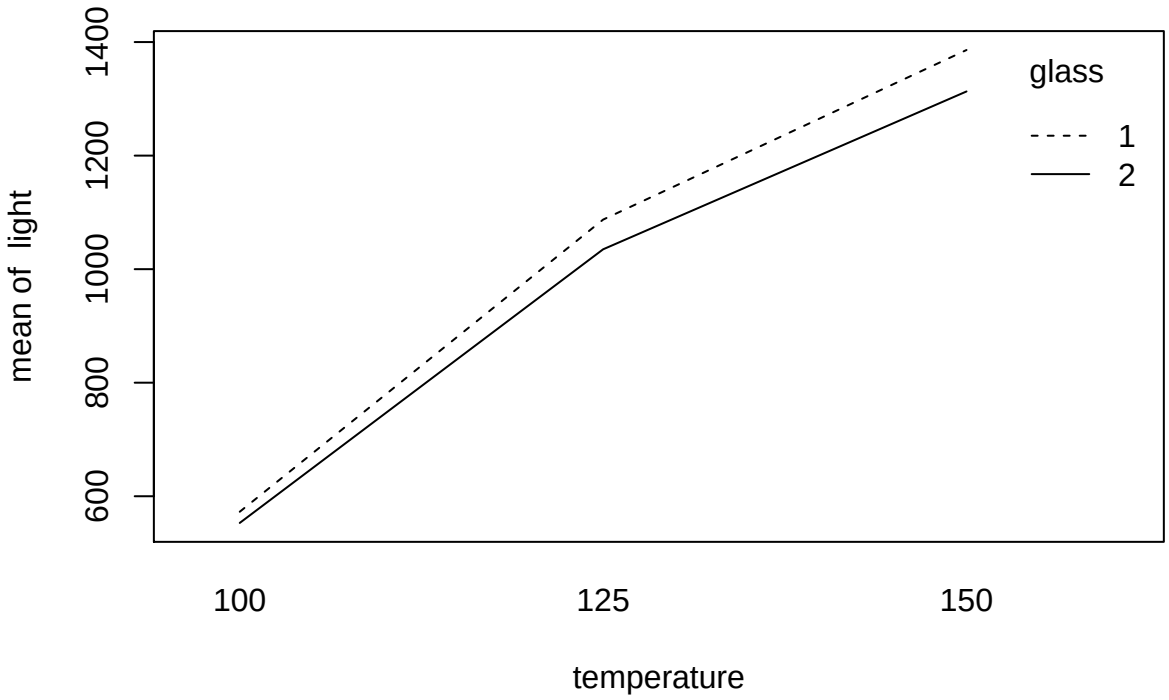
```
light <- c(580, 1090, 1392, 568, 1087, 1380, 570, 1085, 1386,
    550, 1070, 1328, 530, 1035, 1312, 579, 1000, 1299)
glass <- as.factor(c(rep(1, 9), rep(2, 9)))
temperature <- as.factor(rep(c(rep(100, 1), rep(125, 1), rep(150, 1)), 6))
df <- cbind(glass, temperature, light)

resp.aov <- aov(light ~ glass*temperature)
summary(resp.aov)
```

```
##                   Df  Sum Sq Mean Sq F value   Pr(>F)
## glass              1   10513   10513   29.66 0.000149 ***
## temperature        2 1900633  950317 2681.14  < 2e-16 ***
## glass:temperature  2    2169    1085    3.06 0.084350 .
## Residuals         12    4253     354
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

According to the ANOVA table above, there is not a significant interaction between the glass type and temperature since the p-value (0.084350) is greater than $\alpha = 0.05$. The main effects of the glass type and temperature, however, are significant since both of their p-values are less than $\alpha = 0.05$.

```
interaction.plot(temperature, glass, light)
```



Since the lines in the interaction plot are almost parallel, this also suggests that there is not a significant interaction between the glass types and temperatures. Additionally, we could see from the interaction plot that glass type 1 on average outputs more light than glass type 2 outputs.