* **Part (a)**

The plot of the residuals against the fitted values shows no obvious departure from the assumption of independence, though variance increase a little bit and then decrease back as the fitted values rise. There is some space in the vertical direction between observation 29 and the other observations, so it might be a possible outlier.

As for Q-Q plot, there is no obvious departure from the assumption of normality, except several observations on the top right are a little far from the line and might be a problem.

The Cook’s distance for 4 observations appear large relative to others. However, the vertical scale on this plot only goes to just over 0.12, which is relatively small for Cook’s distances, so there is no obvious problem.

The plot of the standardized residuals against the leverage values has no Cook’s distance lines, so everything seems fine.

* **Part (b)**

The term *week*’s , so do NOT reject in favor of and conclude that the term *week* does not significantly increase the proportion of the variance explained by the model and it is not a significant addition to the model.

The fitted regression lines:

Blue:

Orange:

Green:

* **Part (c)**

Model:

Where *j* represents the 3 different levels of color: *j*= {“blue”, “green”, “orange”}, and *i*=1, 2, …,10 represents the observations within each of the three *colour* groups. The summary table shows clearly that both *colourgreen*’s and *colourorange*’s p-value are larger than 0.05, hence they are not significant. However, when there are neither *colourgreen* nor *colourorange*, meaning the color of questionnaires is blue, size and intercept are statistically significant. The default treatment contrasts are used with colour group “blue” as the reference level, so the constraint applied is . Group “blue” vs group “green” and group “blue” vs group “orange” have been compared, but group “green” and group “orange” are not, so the contrasts used in this model might not be a good choice.

* **Part(d)**

The estimated response rate for green questionnaires is not in the 95% confidence interval, both of the other two are in. The confidence interval is relatively narrow.

* **Part(e)**

The multiplicative model includes an interaction term which allows for different slopes as well as different intercepts for three different color groups.

The F-test associated with the additional *colours:size* interaction term tests:

, =, : not all

So, as , do not reject in favor of , and conclude that the colours:size interaction term is not a significant addition to the model and that separate slopes for different color groups are NOT required.

What’s more, the p-value for *colours* is larger than 0.05 as well, so it is also not a significant term. Only the p-value of *size* is lesser than 0.05, so it is a significant term to the model.

* **Part(f)**

All of the coefficients of model with only *week A* are significant, for the p-values are far smaller than 0.05.

* **Part(g)**

There has been almost NO real change from the model in part (c), the residual standard error is unchanged at 2.063.

The intra-class correlation coefficient is calculated as follows:

So, there does not appear to any real addition information in the *week* variable.