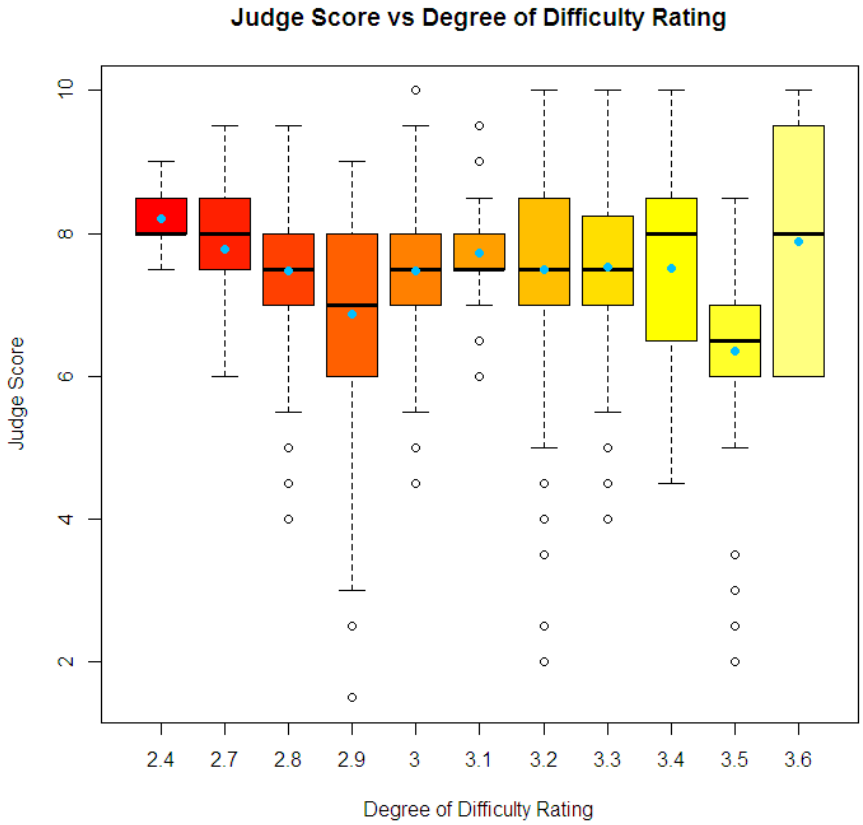
5) Diving, Part II

(some collaboration with Stephen Leh on this section)



`Slope of Green Line: -0.4280  P-Value: 0.000303`

The side-by-side figures are expressing the same data in slightly different fashions. The boxplot on the right side has black lines indicating the median values and teal dots indicating the mean values for those dives conducted within each discrete difficulty level. The scatter plot on the left shows each score given by any of the judges in the final round as a function of the dive difficulty. The green regression line has a slight negative slope with a p-value of 0.000303, which means that there is greater than a 99.9% chance that – if and only if we agree with the assumptions and context of this plot – we can reject the null hypothesis and declare a negative association between degree of difficulty and scores.

However, I do not agree with the assumptions and context of this plot: I have three main concerns which I will address on the following pages.

My first concern is addressed in the figure below. There are seven judges who score each dive. These ratings are dependent on the quality of the dive and therefore the fact that 7 data points appear for a single event artificially increases the correlation due to clustering. I plotted the mean score of these seven judges for each dive against its degree of difficulty. While this did not change the slope of the regression line, it did drastically increase the p-value for this set of data, calling into question the hypothesis of a negative association between degree of difficulty and scores.

A second concern that is worth noting under normal circumstances is that not all divers are created equal; the score is dependent on the quality of the *dive* (mentioned in previous paragraph) and the quality of the *diver*. Not all divers could execute a high-degree-of-difficulty dive at the same level. However, I chose to put aside this concern given that I was analyzing the top few divers in the world, whom I consider to be roughly equivalent in skill level.

Slope of Green Line: -0.4280 P-Value: 0.151

My third main concern is that this data set contains data from 4 distinct subgroups or events: Mens 3 Meter Springboard, Mens 10 meter Platform, Womens 3 Meter Springboard, and Womens 10 Meter Platform. I decided to take a closer look and determine if women and men have significantly different difficulty levels of their dives or significantly different mean scores.

In fact, both of these concerns are well-founded:

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> mean(men$Difficulty)
[1] 3.191667
> mean(women$Difficulty)
[1] 2.905
> mean(menmeans)
[1] 7.597222
> mean(womenmeans)
[1] 7.327976
```

Random sampling of the data could not naturally produce subgroups comparable to those shown above. The two values for the means above were consistently outliers on histograms of the means of hundreds of randomly generated subgroups.

EXTRA CREDIT:

The figure on the following page shows the breakdown between men and women very clearly. Pink dots are women's dives and blue dots are men's dives. The regression lines for each subgroup seem to once again indicate a negative association between score and degree of difficulty. The p-value for the women's dives (0.00213) is excellent and the p-value for men's dives is within the 0.1 significance level (0.0873). Both subgroups have very strong negative regression slope coefficients – much more significant than the negative coefficient for the combined data.

To conclude, I do believe there is evidence – at their respective levels of significance – that men and women both have some strength of a negative association between difficulty of the dive and the score awarded. This conclusion is restricted to the final round data of this particular data set.


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Combined: Slope of Green Line:  -0.4280     P-Value:  0.151
     Men:  Slope of Blue Line:  -0.9038     P-Value:  0.0873
   Women:  Slope of Pink Line:  -1.6124     P-Value:  0.00213
```