# Midterm Exam 1 Grade Analysis

## Calculus III (Spring 2017)

This is a Mathematica notebook that I created to analyze the grades for Midterm Exam 1. Below you will see a few lines of code, then a summary of the output.

This first chunk of code defines the variables. “grades” is the list of the scores earned on the exam, “M” is the mean (average), “S” is the standard deviation, and “Med” is the median.

“dist” is a normal distribution (i.e., mean = median and some other assumptions) of 1000 scores with the same mean and standard deviation that the class earned.

“syll” is a normal distribution of 1000 scores with a mean of 77 (boundary between B and C on the syllabus) and a standard deviation of 10.

I used 1000 scores because the distributions are “random”. If I used only 22 scores, the number of data points would be the same, but the comparison in the charts below would not necessarily be accurate. In case you’re interested, another (potentially better?) way to compare the data is to run many (1000+ ish) simulations of distributions with only 22 scores, then look for trends in the simulations. This requires a lot more carefully thought out coding though. (Not my area of expertise!)

```
grades =
  {54, 72, 66, 72, 67, 54, 89, 60, 99, 92, 63, 72, 77, 91, 70, 85, 76, 80, 89, 69, 72, 52};
M = Mean[grades];
S = StandardDeviation[grades];
Med = Quantile[grades, 1 / 2];
dist = RandomVariate[NormalDistribution[M, S], 1000];
syll = RandomVariate[NormalDistribution[77, 10], 1000];
```

The Mean, Standard Deviation, and Median that the class earned on this exam were:

```
N[M] (* Mean *)
```

```
73.6818
```

```
N[S] (* Standard Deviation *)
```

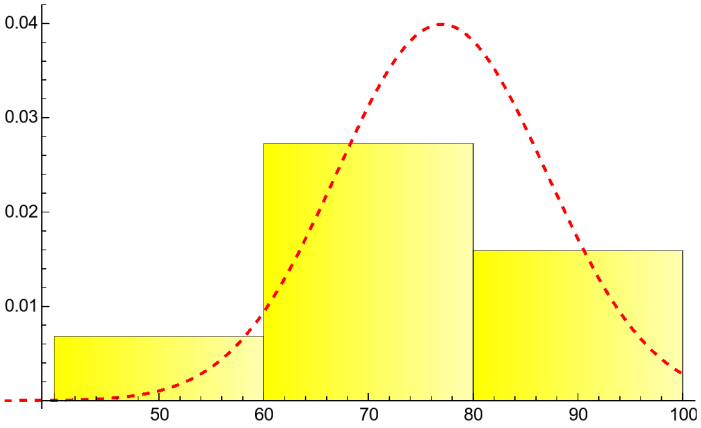
```
13.1417
```

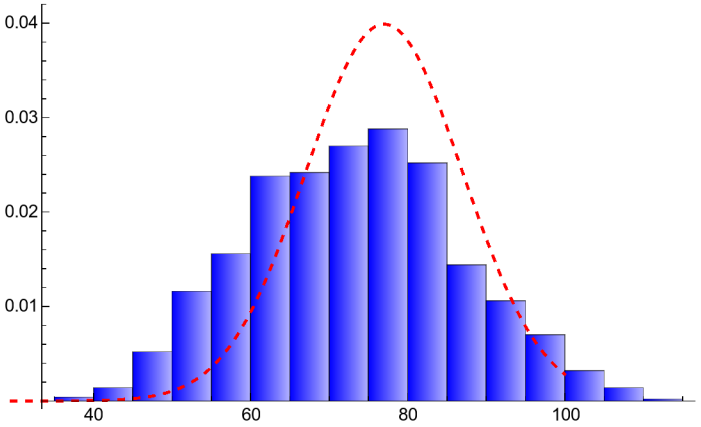
```
Med (* Median *)
```

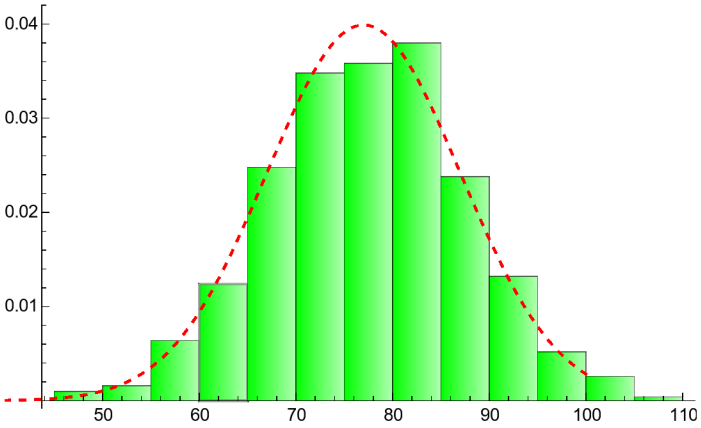
```
72
```

Below are histograms of each distribution. The yellow one is of the actual grades earned, blue is the normal distribution with the same mean and standard deviation as the class, and green is the normal distribution with syllabus-inspired mean and standard deviation.

```
Show[Histogram[grades, Automatic, "PDF" ,
  ChartElementFunction → "FadingRectangle", ChartStyle → Yellow],
 Plot[PDF[NormalDistribution[77, 10], x], {x, 0, 100}, PlotStyle → {Red, Dashed}]]
Show[Histogram[dist, Automatic, "PDF",
  ChartElementFunction → "FadingRectangle", ChartStyle → Blue],
 Plot[PDF[NormalDistribution[77, 10], x], {x, 0, 100}, PlotStyle → {Red, Dashed}]]
Show[Histogram[syll, Automatic, "PDF",
  ChartElementFunction → "FadingRectangle", ChartStyle → Green],
 Plot[PDF[NormalDistribution[77, 10], x], {x, 0, 100}, PlotStyle → {Red, Dashed}]]
```

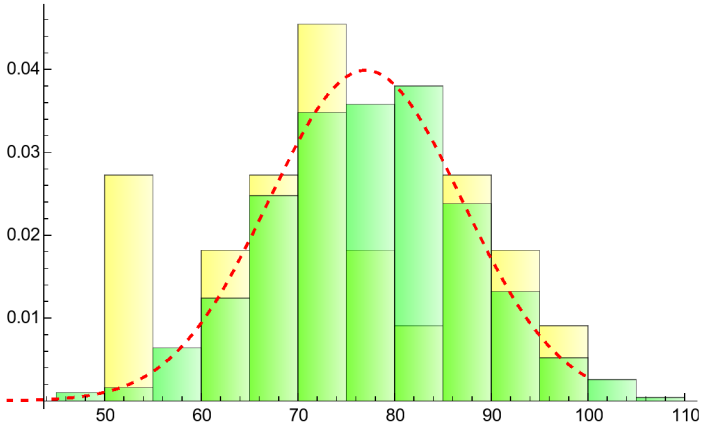


Below is a plot of all three histograms on the same set of axes. If you can make sense of it, this one shows how the class did relative to the normal distributions.

```
Show[Histogram[{grades, syll}, Automatic, "PDF",
  ChartElementFunction → "FadingRectangle", ChartStyle → {Yellow, Green}],
 Plot[PDF[NormalDistribution[77, 10], x], {x, 0, 100}, PlotStyle → {Red, Dashed}]]
```




And finally, below is a box plot of the three distributions with the same color coding.

```
BoxWhiskerChart[{grades, dist, syll}, ChartStyle → {Yellow, Blue, Green}]
```