

# Is A Golf Ball's Mass Related To Its Ball Number

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## Abstract

We statistically concluded using a oneway ANOVA hypothesis test that there is insufficient evidence that a golf balls mass is related to its ball number. Hence the ball number can not be used to indicate the characteristics of the ball, such as time of flight or bounciness, but must merely be used as an aid to identify balls during game play.

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## 1 Introduction

A golf ball is composed of 2, 3, or 4 layers of varying density, and elasticity [2]. On the outer shell a number is printed, generally in red or black. This number may indicate a property of the ball, such as its bounciness, it may indicate the construction method of the ball, or it could simply be used to identify the ball during game play.

One possible way to change the properties would be to vary the material that composes it. Since the dimensions of the ball must remain the same, more than likely the density of the material would vary with any change in say, elasticity or compression. A change in density would hence be measurable as a change in ball mass. Therefore there may be a relationship between the ball number and its mass, which is what we investigated.

## 2 Experimental procedure

The golf balls used in this analysis were balls lost during the day by golfers on a local course, they were collected during afternoon walks through course. Therefore the set is an assortment of different brands,

ball numbers, and degree of wear. The most popular ball number was 2, most were in a relatively new condition, in total there were 94 balls. The distribution of balls was slightly skewed to the left, with a mean of 2, see figure 1.

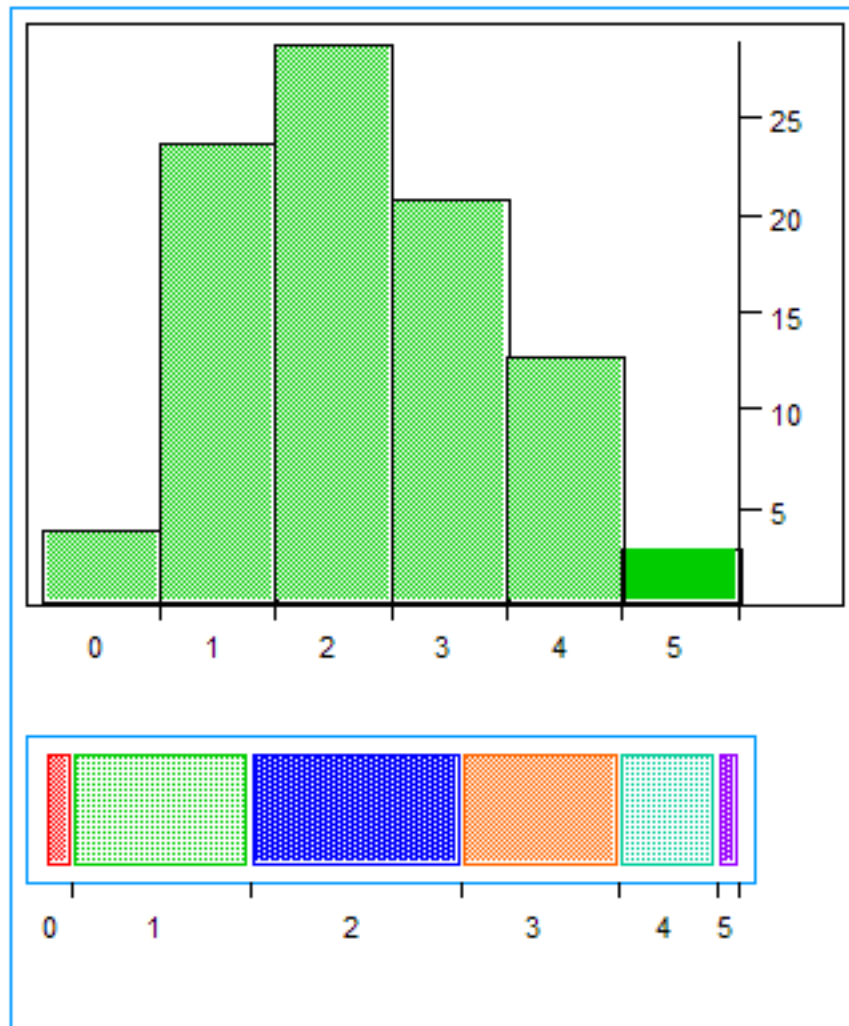


Figure 1: Distribution of ball numbers

The mass was measured using a kitchen scale which operates by the principle of compressing a spring and reading its length. It had a limit of reading of 5g, and therefore an error of  $2.5g^1$ , this is a relatively large error.

Each ball was placed in a small disc to stop it rolling from the scale<sup>2</sup>, and its mass recorded. Initially the mass of each ball was recorded 3 times to reduce experimental error. However, although the accuracy of the scales was low, the same value was consistently obtained; most likely because the stability of the scales and the reproducibility of positioning the ball were both good. Therefore the a single measurement

<sup>1</sup>standard half limit of reading experimental error.

<sup>2</sup>The mass of the disc was factored into the calibration of the scale.

per ball was sufficient for the accuracy of the scales used.

A tabulated set of data containing ball number and ball mass was created. This data set was analyzed using a oneway ANOVA hypothesis test and the statistical software package JMP [1].

## 2.1 Hypothesis test

Null hypothesis:  $H_0 := \mu_1 = \mu_2 = \dots = \mu_n$ , where  $\mu_i$  is the mean mass value of the  $i^{th}$  ball number, and  $n$  is the maximum ball number in the set,  $n = 5$ .

Alternative Hypothesis:  $H_1 : \mu_a \neq \mu_b$ , where  $a$  and  $b$  are any ball numbers less than  $n$ .

A oneway ANOVA test was used to determine the test statistic and p-value, and hence draw a conclusion about the relationship between ball mass and ball number.

## 3 Results

It is clear from figure 2 that the ball mass is not related to the ball number in any obvious or dramatic way. An hypothesis test was performed to verify this conjecture.

### 3.1 Oneway ANOVA hypothesis test

The ANOVA test returned a test statistic of 1.36 and a p-value of 0.247. Using a reasonable significance level of  $\alpha = 0.05$  we clearly can not reject the null hypothesis as there is a 25% chance that we could observe data like this if it were true. Therefore we conclude that there is insufficient evidence that a golf ball's mass is related to its ball number.

It was assumed that the experimental error in the mass measurements had hidden a more normal distribution of mass with the same same mean and variance as was determined experimentally. Therefore with a more accurate mass scale the mean of each group would be the same as was found with the low accuracy scale which was used.

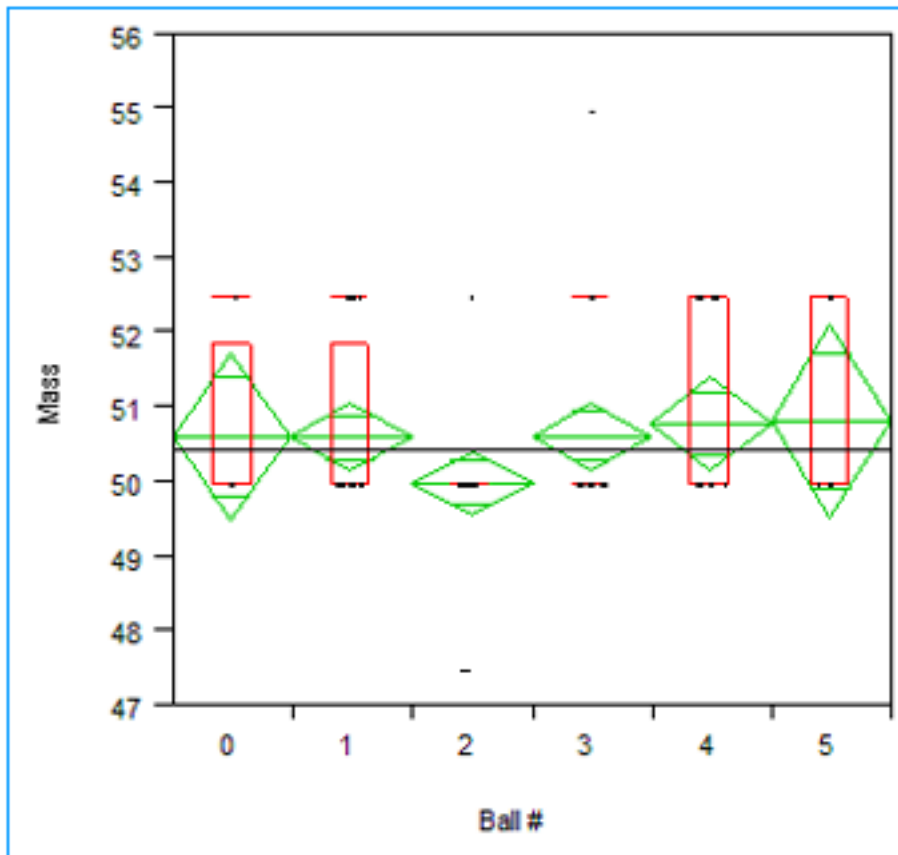


Figure 2: Plot of ball mass vs ball number

### 3.2 Discussion

If the ball's mass is not related to its ball number then, following the arguments in section 1 the ball number can not indicate a difference in any of the properties of the ball, such as time of flight or bounciness, since any such change should be accompanied by a change in density and hence mass, which was not observed. Therefore it is likely that the number is simply used within the game to identify the ball.

According to [3] the ball number's are indeed used to aid in identifying the ball within the game and do not indicate anything about its characteristics.

Interestingly the distribution of ball numbers, figure 1, follows a non-uniform distribution; centered on ball number 2 and skewed to the left. A uniform distribution would be expected if the ball selection process was random, and a normal distribution if a particular ball number was preferred in general. A similar distribution was found in [4]. Since the ball number has been shown to only aid in identification, does this non-uniform distribution imply that;

- The favorite number of golfers is 2.
- Ball manufacturers prefer make balls with the number 2.
- People that use balls with number 1 are better players and hence lose less balls.
- You are more likely to confuse your ball with the ball of someone else if your's has the number 2.
- Golfers **think** that a ball with the number 2 has the particular characteristics that they desire compared to balls with other numbers.

A further study involving the interviewing of golfers would be required to clarify these implications.

## 4 Conclusion

We statistically concluded using a oneway ANOVA hypothesis test that there is insufficient evidence that a golf ball's mass is related to its ball number, and that the ball number is most likely used to aid in identifying the ball during game play.

## References

- [1] Jmp discovery - ver 3.2.5. <http://www.jmp.com/>. Accessed - 9/2002.
- [2] ApexGolfer.com. Golf balls. <http://www.apexgolfer.com/golfballs.html>. Accessed - 9/2002.
- [3] jwt2@Lehigh.EDU. Re: Numbers?????, rec.sport.golf. Usenet Article, 4th September 1995.
- [4] Allan Rossman Randall Pruum. Golf balls in the yard. <http://www.calvin.edu/~rpruum/courses/materials/stats/demos/golf-input.shtml>, 25 January 2002. Accessed - 9/2002.