

Math 106 Exam 1 Solutions
Brad Hartlaub - Fall 2008

1. a. Yes, the mean distance is 172.6 and the std deviation of distance is 88.7 for both hands. If you want to test skill (reaction time) with the mouse, then you want the distances to be as similar as possible for both hands.

b. Numerical Comparison

	mean	std Dev	Min	Q1	Median	Q3	Max
Left:	216.8	73	113	170.8	205	240	401
Right:	104.25	8.25	95	96	103.5	111	123

graphically: Boxplots are best, but dotplots, stem-and-leaf plots or histograms can also be used to make the comparison.

The boxplots and descriptive statistics clearly show a smaller median & mean for the right hand. There is also considerably less variability in the times for the right hand. Thus, this subject appears to be right handed.

c. The left hand times contain an outlier, 401 ms, so the median = 205 ms and the IQR = $240 - 170.8 = 69.2$ ms are preferred to the mean and std. deviation.

d. The z-score for the right-handed time of 110 ms is

$$z = \frac{110 - 104.25}{8.25} = 0.697. \text{ Thus, 110 is approximately}$$

0.7 std deviations above the mean of the right-handed times.

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- i. e. No, the scatterplots indicate a very weak positive association between time and distance for both hands.
- f. Left: $r = .318$
Right: $r = .305$ $\rightarrow$ Both values indicate a weak, positive association.
- g. Left: $\hat{\text{time}} = 171.55 + .2619 \text{ distance}$ or $\hat{\text{time}} = 172 + .262 \text{ distance}$
Right: $\hat{\text{time}} = 99.364 + .02831 \text{ distance}$ or $\hat{\text{time}} = 99.4 + .0283 \text{ distance}$
- h. Left: No, the residual plot of residuals versus fitted values shows considerable variability about the least squares line, but no unusual pattern. $r^2 = .101$
Only 10% of the variability in time is being explained by linear regression with distance as the explanatory variable.
- Right: No, the residual plot shows a slight pattern (negative residuals, followed by positive residuals, followed by negative residuals again). Only 9.3% of the variability in time is explained by using least squares regression with distance as the predictor variable.
- (i.) Neither of these systematic effects of time is present in the plots of residual versus order. No patterns are obvious in these two residual plots.

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2. a. The sample size for the Excite Poll is $n = 4316 + 8986 + 1182 = 14,484$
- b. No, this poll clearly consists of volunteers who decided to participate. Note that we have no guarantee that these responses came from 14,484 distinct people; some may have voted more than once.
3. a. Let $X = \#$ of calls to this customer service representative that are resolved ~~in~~ ^{within} 5 minutes; $X \sim B(n=15, p=.7)$
 $P(X=15) = (.7)^{15} = .0047$
- b. $P(X=0) = (.3)^{15} = 1.439 \times 10^{-8}$ (a very small probability)
- c. Let $Y = \#$ of calls NOT resolved ~~in~~ ^{within} 5 minutes; $Y \sim B(n=15, p=.3)$
$$\begin{aligned} P(Y \geq 1) &= 1 - P(Y=0) = 1 - P(X=15) \\ &= 1 - .0047 \\ &= \cancel{.9953} .9953 \end{aligned}$$
- d. No, the probabilities would not be the same for each customer service representative. For example, representatives with less experience ~~may~~ usually require more time to resolve questions from customers. (The probability of resolving a question within 5 minutes will vary from representative to representative.)

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4. Even though the researchers randomly selected the records of 2500 children, they did not impose any treatments. Thus, ~~therefore~~ the researchers conducted an observational study.