Problem Set 5 Solutions

Part 1A

A one unit increase in the importance of religion is one's life is associated with a 16.7 percentage point decrease in the probability of supporting gay marriage. Equivalently, as religion moves from not at all important to very important, the probability of supporting gay marriage drops by 49.8 percentage points. Turning to party identification, a one unit increase on the three point party identification scale is associated with a 18.7 percentage point increase in the probability of supporting gay marriage. Put another way, shifting from Republican to Democrat increases the probability of supporting gay marriage by 37.4% percentage points. As for marital status, being married decreases the probability of supporting gay marriage by 5.9 percentage points. Finally, someone one views religion as not at all important, is an independent, and unmarried has an 87.3% probability of supporting gay marriage.

Part 1B

95% CI = **β** ± 1.96 (SE)

pewreligimp: -.166 ± 1.96(.0017) = (-.169, -.163)

democrat: .188 ± 1.96(.0024) = (.183, .193)

married: -.059 ± 1.96(.0039) = (-.067, -.051)

constant: .873 ± 1.96(.0043)=(.865, 881)

Part 2A

False. The larger sample size would likely get us closer to the mean if we only took one sample of each size. However, as we take more and more samples, the mean of the sampling distribution converges to the population mean in both cases (as per the law of large numbers).

Part 2B

True. The central limit theorem tells us that as the sample size becomes large, the sample average approaches the population mean, μ, with a standard deviation = $\frac{\sigma}{\sqrt{n}}$

For the sample sizes of 10 and 1000 this gives us $\frac{\sigma}{\sqrt{10}}$ and $\frac{\sigma}{\sqrt{100}}$ or $\frac{\sigma}{3.16}$ and $\frac{\sigma}{31.6}$

Part 3A

To find Prob(X>700), first convert to z-scores, which tells us how many standard deviations away from the mean the score is.

z = $\frac{\bar{X}-\mu}{\sigma/\sqrt{n}} = \frac{700-500}{100} = 2$

We then look up corresponding probability in online chart and subtract from 1

1 – .977 = .023 or 2.3%

Part 3B

z = $\frac{\bar{X}-\mu}{\sigma/\sqrt{n}} = \frac{505-500}{100/10} = 0.5$

Look up corresponding probability in chart =.69

Subtract from 1 and we get .31

Part 4

First, find the standard deviation of the sample estimate. For a proportion, the formula= $\sqrt{p\,(1-p)} = \sqrt{.64\,(1-.64)} = .48$

z = $\frac{.64-.56}{\frac{.48}{\sqrt{36000}}}$ = 31.62 (31.62 standard deviations away from the mean)

Look up corresponding probability in chart = <0.0001

This means the probability that the sample mean is equal to the true population mean is <0.0001. In other words, this number is way too high!

Part 5

Here we use the t-test to determine whether the two means are significantly different.

t = $\frac{\bar{X}_1-\bar{X}_2}{SE\,(\bar{X}_1-\bar{X}_2)}$

The formula for calculating the standard error of a difference in proportions = $\sqrt{\frac{p_1\,(1-p_1)}{n_1} + \frac{p_2\,(1-p_2)}{n_2}} = \sqrt{\frac{.66(1-.66)}{16{,}776} + \frac{.68(1-.68)}{19{,}224}} = .005$

$$t = \frac{.66 - .68}{.005} = -4$$

The probability of this t-score is less than .0001. In other words, we are more than 99.99% confident that these two means significantly different.