PO12Q - Introduction to Quantitative Political Analysis II: Worksheet Week 2 - Solutions

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1 | Recoding

```
wdi <- wdi %>%
  mutate(politybin=
           ordered(
             cut(polity5, breaks=c(-11,1,11),
                 labels=c("Dictatorship","Democracy"))))

wdi <- wdi %>%
  mutate(gdpcat=
           ordered(
             cut(gdppc, breaks=c(0,3274.5, 189524),
                 labels=c("Developing","Developed"))))

wdi <- wdi %>%
  mutate(growth=
           ordered(
             cut(gdpgrowth, breaks=c(-Inf,279.417, Inf),
                 labels=c("slow-growing","fast-growing"))))
```

2 | Two-Sample Test of a Proportion

- Which proportion of developing and developed countries are democratic?
  - **developing=63.16%, developed=78.9%**
- Do we verify or falsify our hypothesis at a 95% confidence level?
  - **Yes, $p < 0.05$**

2.1 Exercises

- Is a higher proportion of fast-growing countries democratic than slow-growing countries? Use a 95% confidence level.

```
table(wdi$growth, wdi$democracy)
##
##                  0   1
##    slow-growing  60  70
##    fast-growing   7  41
prop.test(c(75,32),c(110,37), correct=F, alternative = "less")
##
##  2-sample test for equality of proportions without continuity correction
##
## data:  c(75, 32) out of c(110, 37)
## X-squared = 4.6837, df = 1, p-value = 0.01522
## alternative hypothesis: less
## 95 percent confidence interval:
##  -1.00000000 -0.06522477
## sample estimates:
##     prop 1     prop 2
## 0.6818182  0.8648649


#######################################################################
# Yes, they are: the p-value is small enough.
#######################################################################
```

- Now repeat the exercise, but this time with the democracy variable. Do the results differ? Why? Why not?

```
table(wdi$growth, wdi$democracy)
##
##                  0   1
##    slow-growing  60  70
##    fast-growing   7  41
prop.test(c(70,41),c(130,48), correct=F, alternative = "less")
##
##  2-sample test for equality of proportions without continuity correction
##
## data:  c(70, 41) out of c(130, 48)
## X-squared = 14.886, df = 1, p-value = 5.711e-05
## alternative hypothesis: less
## 95 percent confidence interval:
##  -1.0000000 -0.2052814
## sample estimates:
##     prop 1     prop 2
## 0.5384615  0.8541667
#substantively the result do not change, as the test is significant, just at a lower
    significance level
```

- Calculate the last two-sample test by hand.

Standard Error under H_0:

$$\hat{\pi} = (70 + 41)/(130 + 48) = 0.6235955$$

$$se_0 = \sqrt{\frac{\hat{\pi}(1 - \hat{\pi})}{n_1} + \frac{\hat{\pi}(1 - \hat{\pi})}{n_2}} = \sqrt{\hat{\pi}(1 - \hat{\pi})\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}$$

$$= \sqrt{0.624(0.376)\left(\frac{1}{130} + \frac{1}{48}\right)}$$

$$= \sqrt{0.0066928} = 0.08180953$$

$$z = \frac{\hat{\pi}_1 - \hat{\pi}_2}{se_0} = \frac{0.538 - 0.854}{0.08180953} = -3.862631$$

This is well beyond the required 1.96 standard errors required for a 95% confidence level.

3 | Two-Sample Test of Means

- Can we conclude at a 95% confidence level, that people live longer in developed countries than in developing countries?
  - **We can: the p-value is small enough, and the mean in the developing group is smaller than in the developed group**

3.1 Exercises

- Do people live longer under democracies than under dictatorahips? Use a 95% confidence level.

```
leveneTest(wdi$lifeexp ~ wdi$politybin)
## Levene's Test for Homogeneity of Variance (center = median)
##        Df F value Pr(>F)
## group   1  0.2372  0.627
##       151


###############################################################################
# This means we accept H0, and the variances are equal.
###############################################################################

t.test(lifeexp ~ politybin, data=wdi, var.equal = TRUE, alternative="less")
##
##   Two Sample t-test
##
## data:  lifeexp by politybin
## t = -2.1328, df = 151, p-value = 0.01728
## alternative hypothesis: true difference in means between group Dictatorship and group
##    Democracy is less than 0
## 95 percent confidence interval:
##       -Inf -0.692887
## sample estimates:
## mean in group Dictatorship    mean in group Democracy
##                 68.85677                   71.94973


###############################################################################
# They do! The p-value is small.
###############################################################################
```