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(-11,0,11),
                labels=c("Dictatorship","Democracy"))))

wdi <- wdi %>%
  mutate(gdpcat=
          ordered(
            cut(gdppc, breaks=c(-Inf,median(gdppc, na.rm=TRUE), Inf),
                labels=c("Developing","Developed"))))

wdi <- wdi %>%
  mutate(growth=
          ordered(
            cut(gdpgrowth, breaks=c(-Inf,mean(gdpgrowth, na.rm=TRUE), Inf),
                labels=c("slow-growing","fast-growing"))))
```

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2 | Two-Sample Test of a Proportion

- Which proportion of developing and developed countries are dictatorships?
  - **developing=29.87%, developed=22.86%**
- Do we verify or falsify our hypothesis at a 95% confidence level?
  - **We fail to reject the null hypothesis, 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$growth, wdi$politybin)
##
##                 Dictatorship Democracy
##    slow-growing           34        76
##    fast-growing            5        32
prop.test(c(76,32),c(110,37), correct=F)
##
##   2-sample test for equality of proportions without continuity correction
##
## data:  c(76, 32) out of c(110, 37)
## X-squared = 4.2983, df = 1, p-value = 0.03815
## alternative hypothesis: two.sided
## 95 percent confidence interval:
##   -0.31392718 -0.03398437
## sample estimates:
##     prop 1    prop 2
## 0.6909091 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)
##
##   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 = 0.0001142
## alternative hypothesis: two.sided
## 95 percent confidence interval:
##   -0.4472831 -0.1841271
## sample estimates:
##     prop 1    prop 2
## 0.5384615 0.8541667


###############################
## same as before
###############################
```

- 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  0.0893 0.7655
##       151


###############################################################
# This means we fail to reject H0, and the variances are equal.
###############################################################

t.test(lifeexp ~ politybin, data=wdi, var.equal = TRUE)
##
##   Two Sample t-test
##
## data:  lifeexp by politybin
## t = -2.1588, df = 151, p-value = 0.03244
## alternative hypothesis: true difference in means between group Dictatorship and group Democracy is not
##     equal to 0
## 95 percent confidence interval:
##   -6.0373696 -0.2672346
## sample estimates:
## mean in group Dictatorship    mean in group Democracy
##                  68.79351                   71.94581


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