Portfolio of Research Questions

Testing the prediction of a criterion using ***two*** interval-scaled predictors

Purpose:

This assignment is designed for the student to practice the following:

1) Composing a research question that can be "answered" by testing a set of two predictors as well as the statistical significance of each of the two interval-scaled predictors (each predictor with a one-tailed H_1), and the intercept
2) Presenting all four hypothesis testing steps needed, and
3) Presenting results of analysis.

Checklist:

The following checklist will be used to evaluate students' work:

Item	Note
Verbal description of the research study:	Make sure the following are included: statement of ***research question***, definition of ***variables*** of interest.
Data	Provide a Table containing the data used in the analysis. Also post data in.csv format on **Canvas**
Large enough sample	***Minimum*** of n=***15***
Appropriate scales for measures	Interval/ratio scaled (for outcome and for each of the two predictors). Predictors will be centered.
Statement of H_0 and H_1	In English for each of four hypotheses (see below) with ***one-tailed*** hypotheses for the tests of the slopes and intercept.
Choice of ***critical values***	Indicate α-level used, df, sign (+ or – or ±) and value of critical test statistic used to test each hypothesis.
Calculation of ***sample test statistic***.	For the parts you are calculating by hand, show your work. For the parts you do using statistical software provide the code (if **R**) and provide all relevant parts of output with the relevant information **highlighted** or **circled**. However, you DO still need to provide each relevant critical test statistic value.
Conclusion drawn – decision about H_0	Fail to reject or reject H_0? (for each test)
Conclusion in ***English***	Including appropriate use of "significant" and (be sure to match this with your decision about H_0).
Statistical conclusion	The presentation of the ***statistical results*** provides relevant information.
Interpretation of coefficient's value	Be sure to tell us how you are centering each predictor. Include one or two sentences (for each test) describing to a reader how to interpret the value of each unstandardized regression coefficient estimate (even if results are not statistically significant - just for practice).

E.g. A researcher was interested in investigating whether the number of publications (*Pubs*) and enjoyment of teaching (*Enj*) were positive predictors of a professor's general life contentment (*GLC*). Both predictors were ***mean-centered***. Using the sample of data for 133 professors found in ***twopreds.port.CSV***, test the researcher's hypothesis using α of 0.05

1) H_{1A}: The predictors (the number of publications and enjoyment of teaching) explain variability in a professor's general life contentment.

H_{0A}: The predictors (the number of publications and enjoyment of teaching) do not explain variability in a professor's general life contentment.

H_{1B}: The number of publications (while controlling[1] for enjoyment of teaching) is a negative predictor of a professor's general life contentment.

H_{0B}: The number of publications (while controlling for enjoyment of teaching) is not a negative predictor of a professor's general life contentment.

H_{1C}: Enjoyment of teaching (controlling[1] for the number of publications) is a positive predictor of a professor's general life contentment.

H_{0C}: H_{1C}: Enjoyment of teaching (controlling for the number of publications) is not a positive predictor of a professor's general life contentment.

[1] "Controlling for" = for two people with same value on other predictor(s)

H_{1D}: General life contentment for a professor with the mean number of publications and the mean amount of enjoyment of teaching is greater than zero.

H_{0D}: General life contentment for a professor with the mean number of publications and the mean amount of enjoyment of teaching is not greater than zero.

2) For testing H_{0A}: $\alpha = 0.05$, $df_{Reg} = 2$, $df_{Error} = 130$; critical $\boldsymbol{F}$ **(2, 130) = 3.066**

For testing H_{0B}: $\alpha = 0.05$, $df = 130$, critical $\boldsymbol{t}$**(130) = –1.657**

For testing H_{0C} and H_{0D}: $\alpha = 0.05$, $df = 130$, critical $\boldsymbol{t}$**(130) = 1.657**

3) Sample test statistic results:

First, mean-center each of the two predictors:

```
twopreds.port$pubs.ctrd <-
     scale(twopreds.port$pubs,
     center = TRUE,
     scale = FALSE)
twopreds.port$enj.tch.ctrd <-
     scale(twopreds.port$enj.tch,
     center = TRUE,
     scale = FALSE)
```

Then use:

```
Summary ( lm(twopreds.port$glc ~
              twopreds.port$enj.tch +
              twopreds.port$pubs))
```

Obtaining

```
                            Estimate Std. Error t value Pr(>|t|)
(Intercept)                 74.11278    0.31823 232.894  < 2e-16 ***
twopreds.port$enj.tch.ctrd  0.79784     0.03923  20.335  < 2e-16 ***
twopreds.port$pubs.ctrd    -0.38645     0.04514  -8.562 2.74e-14 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 3.67 on 130 degrees of freedom
Multiple R-squared:  0.7764,   Adjusted R-squared:  0.773
F-statistic: 225.7 on 2 and 130 DF,  p-value: < 2.2e-16
```

And use:

```
lm(formula = scale(glc) ~
                  scale(enj.tch.ctrd) +
                  scale(pubs.ctrd),
                  data = twopreds.port)

Coefficients:
        (Intercept)  scale(enj.tch.ctrd)     scale(pubs.ctrd)
          9.199e-16            1.111e+00           -4.677e-01
```

4) CONCLUSIONS:

For testing H_{0A}:

```
Multiple R-squared:  0.7764,   Adjusted R-squared:  0.773
F-statistic: 225.7 on 2 and 130 DF,  p-value: < 2.2e-16
```

Reject H_{0A} and conclude that the predictors (the number of publications and enjoyment of teaching) explain a significant amount of variability in a professor's general life contentment.

$$[R^2 = .776,\ R^2_{adj} = .773,\ F(2,130) = 225.7,\ p < .05].$$

Together, a professor's number of publications and enjoyment of teaching explain about 77.3% of the variability in the professor's general life contentment.

For testing H_{0B}:

```
                          Estimate Std. Error t value Pr(>|t|)
(Intercept)               74.11278    0.31823 232.894  < 2e-16 ***
twopreds.port$enj.tch.ctrd  0.79784    0.03923  20.335  < 2e-16 ***
twopreds.port$pubs.ctrd    -0.38645    0.04514  -8.562 2.74e-14 ***
```

And

```
      (Intercept)  scale(enj.tch.ctrd)     scale(pubs.ctrd)
        9.199e-16            1.111e+00           -4.677e-01
```

Reject H_{0B} and infer that the number of publications (while controlling for enjoyment of teaching) is a significant negative predictor of a professor's general life contentment

$$[B = -0.386, \beta = -0.468, t(130) = -8.562, p < .05].$$

The results indicate that, controlling for how much a professor enjoys teaching, the more a professor publishes, the less generally contented they will be. Specifically, for two professors who equally enjoy teaching, for the professor with one more publication, that professor is predicted to be 0.386 points lower on the measure of general life contentment.

For testing H_{0C}:

```
                          Estimate Std. Error t value Pr(>|t|)
(Intercept)               74.11278    0.31823 232.894  < 2e-16 ***
twopreds.port$enj.tch.ctrd  0.79784    0.03923  20.335  < 2e-16 ***
twopreds.port$pubs.ctrd    -0.38645    0.04514  -8.562 2.74e-14 ***
```

And

```
      (Intercept)  scale(enj.tch.ctrd)     scale(pubs.ctrd)
        9.199e-16            1.111e+00           -4.677e-01
```

Reject H_{0C} and infer that enjoyment of teaching (controlling for number of publications) is a significant positive predictor of a professor's general life contentment

[$B = 0.798$, $\beta = 1.111$, $t(130) = 20.335$, $p < .05$].

The results indicate that, controlling for the number of publications, the more a professor enjoys teaching, the more generally contented they will be. In other words, for two professors with the same number of publications, for the professor reporting one point higher on the enjoyment of teaching scale, that professor would be predicted to have almost one (actually, 0.798) higher point on the *GLC* scale. For testing H_{0D}:

```
                          Estimate Std. Error t value Pr(>|t|)
(Intercept)               74.11278    0.31823 232.894  < 2e-16 ***
twopreds.port$enj.tch.ctrd  0.79784    0.03923  20.335  < 2e-16 ***
twopreds.port$pubs.ctrd    -0.38645    0.04514  -8.562 2.74e-14 ***
```

Reject H_{0D} and infer that general life contentment for a professor with the average number of publications and average enjoyment of teaching is significantly greater than zero

[$B = 74.113$, $t(130) = 232.894$, $p < .05$].

The intercept is interpreted as the predicted *GLC* score (estimated to be 74.113) for someone at the mean on number of publications and at the mean on the enjoyment of teaching scale.