"Statistical thinking will one day be as necessary for efficient citizenship as the ability to read and write."  H. G. Wells.

PART I (5 points)

True and False – Add short explanation to your selection

1. One of the main objectives of simple linear regression is to determine the type of relationship that exists between X and Y and test for its significance.
   TRUE

2. If you want to know if your salary depend on your college GPA. Then, College GPA in this case is the dependent variable.
   FALSE – The dependent variable is salary

3. We want to test whether ex husbands and ex wives have the same reasons to justify the divorce? This is pair sample t-test.
   FALSE – Independent T-Test

4. In the article “Students Perceptions of satisfaction and anxiety on online doctoral program…” The authors concluded (p. 91) “Students with lower technological anxiety scores experienced higher level of satisfaction” – They performed a one-tailed test correlation.
   FALSE – The test used was the two-tailed test

5. In the article “Do perceptions of college students from one liberal arts college on long island vary…” The authors show how wealthy students outperformed poor in the uses of spreadsheets.
   FALSE – Wealthy was never used in the study

Section 2 (5 points)

1. Research about effect size and give an example about it. Why is this important? Effect size = r^2 for ANOVA. The ‘specific’ percent of variance accounts for the change.
2. **What’s the difference between p-value and effect size?**
   The difference between p-value and effect size is p-value is significance and effect size is the percent of variance the independent variable has on the dependent variable.

3. A researcher used correlation to examine the relationships between a binary predictor variables (e.g. Asian American versus Caucasian) and a continuous criterion variable (AP physics score).
   He coded:
   Asian American (AA) = 1
   Caucasian (C) = 2

   Please explain the following results:

   For ethnic (AA=1, C=2) and AP physics score:  \( r = .34, p = .054 \)
   No correlation/relationship between Caucasians and Asian Americans.

   For ethnic (AA=1, C=2) and AP physics score:  \( r = -0.6, p = .001 \)
   The correlation is negative. Asian Americans are performing better in Physics than Caucasians.

4. **Matching (2 points)**
   - Paired Sample T-Test - Involves pretest and post-test
   - ANOVA - Involves Mean differences
   - Two-way ANOVA - Involves interaction among 2 variables or factors
   - Binary Linear Regression - Addresses relationship between 2 variables

**Part III (10 points)**

2. Multiregression and correlation (5 points)
Based on the data set from the Multiple regression chapter, we conducted a multiregression analysis to predict the overall injury index from previous medical difficulties and age

**Dependent Variable = Injury**

**Independent Variables (7 variables) =** medimex, age, abdoms, gluts, quads, grip, arms

- We checked distributions → all the variables showed normal distribution
- Table 1 shows the bivariate correlations between independent variables and dependent variable
- Table 2 shows the multiregression results

<table>
<thead>
<tr>
<th>CORRELATION</th>
<th>INJURY</th>
<th>QUADS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>INJURY</strong></td>
<td>Pearson Correlation</td>
<td>.1</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td></td>
<td>.1</td>
</tr>
<tr>
<td>N</td>
<td>100</td>
<td>1</td>
</tr>
<tr>
<td><strong>QUADS</strong></td>
<td>Pearson Correlation</td>
<td>-.162</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td></td>
<td>.107</td>
</tr>
<tr>
<td>N</td>
<td>100</td>
<td>1</td>
</tr>
<tr>
<td><strong>GLUTS</strong></td>
<td>Pearson Correlation</td>
<td>-.393**</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td></td>
<td>.000</td>
</tr>
<tr>
<td>N</td>
<td>100</td>
<td>1</td>
</tr>
<tr>
<td><strong>ABDOMS</strong></td>
<td>Pearson Correlation</td>
<td>-.232*</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td></td>
<td>.020</td>
</tr>
<tr>
<td>N</td>
<td>100</td>
<td>1</td>
</tr>
<tr>
<td><strong>ARMS</strong></td>
<td>Pearson Correlation</td>
<td>-.243*</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td></td>
<td>.015</td>
</tr>
<tr>
<td>N</td>
<td>100</td>
<td>1</td>
</tr>
<tr>
<td><strong>GRIP</strong></td>
<td>Pearson Correlation</td>
<td>-.099</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td></td>
<td>.328</td>
</tr>
<tr>
<td>N</td>
<td>100</td>
<td>1</td>
</tr>
<tr>
<td><strong>AGE</strong></td>
<td>Pearson Correlation</td>
<td>.290**</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td></td>
<td>.003</td>
</tr>
<tr>
<td>N</td>
<td>100</td>
<td>1</td>
</tr>
<tr>
<td><strong>MEDINDEX</strong></td>
<td>Pearson Correlation</td>
<td>.337**</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td></td>
<td>.001</td>
</tr>
<tr>
<td>N</td>
<td>100</td>
<td>1</td>
</tr>
</tbody>
</table>

**.** Correlation is significant at the 0.01 level (2-tailed).

**.** Correlation is significant at the 0.05 level (2-tailed).

Table 1. Bivariate Correlations (also call zero-order correlations)
Questions:
1) From table 2,
   a) write the multiregression equation based on the unstandardized coefficients
      \[ 0.54 \text{ quads} - 3.386 \text{ gluts} - 0.682 \text{ abdomen} - 0.842 \text{ arms} + 0.805 \text{ grip} + 5.331 \text{ age} - 89.909 \text{ medium index} - 141.553 = \text{Injury} \]

   \[ \text{INJURY} = \]

   b) Interpretation of betas:
      
      • Interpret “b” for quads -- for each 1-unit increase in quads, injury is expected to up by 0.54 when holding all other variables constant.
      • Interpret “b” for gluts -- for each 1-unit increase in support, injury is expected to down by 3.386, when holding all other variables constant
      • Interpret “constant” -- if a person has a score of “0” on all predictors, their injury is expected to be -141.553.
      • The 2 best predictors of the injury index are (Tip, check magnitude of betas, and p-values): Gluts and age
      • The 2 worst predictors of the injury index are: Grip and medical index
2) There are 5 patterns of bivariate/multiregression relationship as shown in Table 3:

<table>
<thead>
<tr>
<th>Multiple regression weight</th>
<th>Simple correlation with the criterion</th>
<th>Bivariate relationship and multivariate contribution (to this model) have same sign</th>
<th>&quot;Suppressor variable&quot; – no bivariate relationship but contributes (to this model)</th>
<th>&quot;Suppressor variable&quot; – bivariate relationship &amp; multivariate contribution (to this model) have different signs</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>0</td>
<td>Non-contributing – probably because colinearity with one or more other predictors</td>
<td>Non-contributing – probably because of weak relationship with the criterion</td>
<td>Non-contributing – probably because colinearity with one or more other predictors</td>
</tr>
<tr>
<td>+</td>
<td>&quot;Suppressor variable&quot; – bivariate relationship &amp; multivariate contribution (to this model) have different signs</td>
<td>&quot;Suppressor variable&quot; – no bivariate relationship but contributes (to this model)</td>
<td>Bivariate relationship and multivariate contribution (to this model) have same sign</td>
<td></td>
</tr>
</tbody>
</table>

There are 5 patterns of bivariate/multivariate relationship

- Simple correlation with the criterion
  - 0
  - +

- Non-contributing – probably because colinearity with one or more other predictors
- Non-contributing – probably because of weak relationship with the criterion
- Non-contributing – probably because colinearity with one or more other predictors

- "Suppressor variable" – bivariate relationship & multivariate contribution (to this model) have different signs
- "Suppressor variable" – no bivariate relationship but contributes (to this model)

- Bivariate relationship and multivariate contribution (to this model) have same sign


c) Explain the relationship between each independent variables and the model (Tip: You need the information on Tables 1, 2 and 3).
Quads 0,0 --- non-contributing
Gluts -, - --- bivariate
Abdominals -, 0 --- non-contributing
Arms --, 0 --- non-contributing
Grip 0,0 --- non-contributing
Age +, + --- bivariate
Medical Index +, 0 --- non-contributing

d) Which variable(s) are/is causing colinearity? (if any) Explain colinearity.
Arms, abs, and medical index. Variables have an effect – one ‘eats’ the other.