In each of the following situations, is it more reasonable to simply explore the relationship between the two variables or to view one of the variables as an explanatory variable and the other as a response variable? In the latter case, which is the explanatory variable and which is the response variable? Are they categorical or quantitative (quantitative means "numerical")?

1. The typical number of calories a person consumes per day and that person's percent of body fat.
   a) Number of calories consumed per day: response, quantitative. Percent of body fat: explanatory, quantitative.
   b) Number of calories consumed per day: explanatory, quantitative. Percent of body fat: response, quantitative.
   c) Number of calories consumed per day: response, quantitative. Percent of body fat: explanatory, categorical.
   d) Number of calories consumed per day: explanatory, categorical. Percent of body fat: response, categorical.

2. Water temperature controlled at different levels and growth (measured by weight) of corals in aquariums.

Coffee is a leading export from several developing countries. When coffee prices are high, farmers often clear forest to plant more coffee trees. Here are data on prices paid to coffee growers in Indonesia and the rate of deforestation in a national park that lies in a coffee-producing region, for five years:

<table>
<thead>
<tr>
<th>Price (cents per pound)</th>
<th>Deforestation (percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>29</td>
<td>0.49</td>
</tr>
<tr>
<td>40</td>
<td>1.59</td>
</tr>
<tr>
<td>54</td>
<td>1.69</td>
</tr>
<tr>
<td>55</td>
<td>1.82</td>
</tr>
<tr>
<td>72</td>
<td>3.10</td>
</tr>
</tbody>
</table>
3. Coffee is currently priced in dollars. If it were priced in euros, and the dollar prices in the above table were translated into the equivalent prices in euros, would the correlation between coffee price and percent deforestation change?
   a) The correlation would remain zero, because the two variables are independent
   b) Yes, units affect correlation
   c) No, units do not affect correlation
   d) It is impossible to calculate the correlation, because coffee price is categorical.

A study shows that there is a positive correlation between the size of a hospital (measured by its number of beds (x)) and the median number of days (y) that patients remain in the hospital.

4. What lurking variable could be present in this study?

   a) cost: its more expensive to run larger hospitals.
   b) severity of disease: since large hospitals have better facilities and more doctors to cope with severe illness.
   c) number of visitors: since larger hospitals receive more visitors.
   d) facilities: since larger hospitals have better facilities, patients choose to stay longer

Over the past decade, there has been a strong positive correlation between teacher salaries and prescription drug costs.

5. Do you think paying teachers more causes prescription drugs to cost more?
   a) Yes. A strong correlation always implies causation.
   b) No. A strong correlation can never go along with causation.
   c) Yes. In this case, a strong correlation likely implies causation.
   d) No. In this case, a strong correlation does not imply causation.
6. Which of the following plots will have a correlation coefficient of .85?

A. 

B. 

C. 

D. 

Problem 1

13) The age distribution of students at a community college is given below. 

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Number of students (f)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 21</td>
<td>404</td>
</tr>
<tr>
<td>21-25</td>
<td>401</td>
</tr>
<tr>
<td>26-30</td>
<td>202</td>
</tr>
<tr>
<td>31-35</td>
<td>53</td>
</tr>
<tr>
<td>Over 35</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>1081</td>
</tr>
</tbody>
</table>

A student from the community college is selected at random. Find the probability that the student is at least 31. Round approximations to three decimal places.

A) 74  B) 0.068  C) 0.049  D) 0.932

Problem 2
14) For a person selected randomly from a certain population, events \( A \) and \( B \) are defined as follows.

\[
A = \text{event that the person is male} \\
B = \text{event that the person is a smoker}
\]

For this particular population, it is found that \( P(A) = 0.47, P(B) = 0.20, \) and \( P(A \& B) = 0.12 \). Find \( P(A \text{ or } B) \). Round approximations to two decimal places.

A) 0.44  
B) 0.55  
C) 0.79  
D) 0.67
11) Three board members for a nonprofit organization will be selected from a group of five people. The board members will be selected by drawing names from a hat. The names of the five possible board members are Alison, Betty, Charlie, Dave, and Emily. The possible outcomes can be represented as follows.

ABC  ABD  ABE  ACD  ACE  
ADE  BCD  BCE  BDE  CDE

Here, for example, ABC represents the outcome that Alison, Betty, and Charlie are selected to be on the board. The events A and B are defined as follows.

A = event that Betty and Alison are both selected
B = event that more than one man is selected

Are the events A and B mutually exclusive?

A) Yes  B) No

Problem 4

Professors sometimes select a student at random to answer a question. If each student has an equal chance of being selected and there are 15 people in your class.

1. What is the chance that David is selected for the next question?

A: David is selected
P(A) = 1/15

2. What is the chance that David is not selected for the next question?

A^c: David is not selected
P(A^c) = 1 - 1/15

3. What is the probability David being picked to answer all three questions? Assume that she will pick the same person more than once in a given lecture.

<table>
<thead>
<tr>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/15</td>
<td>1/15</td>
<td>1/15</td>
</tr>
</tbody>
</table>
a. What property permitted us to multiply the probabilities? Due to the assumption that a student can be selected more than once during class, then student selected in one question is not affected by the student selected in any of the other questions. This is the property of independence and we can multiply the probabilities.

4. If the professor asks 2 questions, what is the probability that David is not selected in any of the two trials? Assume that she will not pick the same person twice in a given lecture.

\[
P(A^c \text{ in Q1 and } A^c \text{ in Q2}) = P(A^c \text{ in Q2} | A^c \text{ in Q1}) \times P(A^c \text{ in Q1})
\]
\[
= \frac{13}{14} \times \frac{14}{15}
\]

Problem 5

Topics: probability of the complement, independence

About 9% of people are left-handed. Suppose 3 people are selected at random. Because the sample size is very small relative to the population, it is reasonable to assume these three people are independent.

5. What is the probability that all are left-handed?

Define A: all are left handed

\[
P(A) = .09 \times .09 \times .09
\]

6. What is the probability that none are left handed?

We look for the complement of A:

\[
P(A^c) = 1 - P(A)
\]

7. What is the probability that the first two people are left-handed?

Possible outcomes: LLL, LLR

\[
.09 \times .09 \times .09 + .09 \times .09 \times (1-.09)
\]

Problem 6
If you roll a pair of fair dice, what is the probability of?

(1,1) (1,2) (1,3) (1,4) (1,5) (1,6)
(2,1) (2,2) (2,3) (2,4) (2,5) (2,6)
(3,1) (3,2) (3,3) (3,4) (3,5) (3,6)
(4,1) (4,2) (4,3) (4,4) (4,5) (4,6)
(5,1) (5,2) (5,3) (5,4) (5,5) (5,6)
(6,1) (6,2) (6,3) (6,4) (6,5) (6,6)

8. A = getting a sum of 2
\[ \frac{1}{36} \]

9. B = getting a sum of 5?
\[ \frac{4}{36} \]