University of Arkansas

Statistical Methods 2019-10-08 **Problem Set 1-1**

Name: _____

Signature: _____

1. (a) [X] (b) [ ] (c) [X] (d) [ ] (e) [ ]
2. (a) [ ] (b) [X] (c) [ ] (d) [ ] (e) [ ]
3. (a) [ ] (b) [X] (c) [ ] (d) [ ] (e) [ ]
4. [ ][ ][ ][1][4][1] . [5][3][8]

1. **Problem**
   Which of these are places in Arkansas?

   (a) Hawksbill Crag
   (b) Lazy River
   (c) Whitaker Point
   (d) Blue Mountain
   (e) Flat-top Mountain

   Solution
   The answer is (a), (c). Whitaker Point and Hawksbill Crag are both the same place and the only places in Arkansas.

2. **Problem**
   Which of the following `R` functions allows you a quick, overview of the data? Make sure you select all that apply.

   (a) modify()
   (b) str()
   (c) summary()
   (d) c()
   (e) simulate()

   Solution
   The answer is (b). The functions `glimpse()`, `str()` and `summary()` print out quick overviews of the data giving the number of varaibles, type of variables, and other quick previews of the data. The function `print()` gives an overview of the data, however the output is not summarized or does `print()` return a quick overview. The functions `lm()`, `c()`, `modify()`, and `simulate()` do not display the data at all .

3. **Problem**
   The following are two vectors

```
x
```

```
## [1] 2 4 6 8
```

```
y
```

```
## [1] 1 2 3 4
```

   What is the code that generates the following output?

```
## [1]  3  6  9 12
```

   (a) x / y
   (b) x + y
   (c) x * y
   (d) x - y
   (e) 2 * x * y

   Solution
   The answer is (b) because vector addition $x + y = \begin{pmatrix} 2 \\ 4 \\ 6 \\ 8 \end{pmatrix} + \begin{pmatrix} 1 \\ 2 \\ 3 \\ 4 \end{pmatrix} = \begin{pmatrix} 2+1 \\ 4+2 \\ 6+3 \\ 8+4 \end{pmatrix} = \begin{pmatrix} 3 \\ 6 \\ 9 \\ 12 \end{pmatrix}$.

4. **Problem**
   21 University of Arkansas pre-law students are taking the LSAT exam (the standardized exam for entry into law school) where the average LSAT score in the United States is 139 with a standard devation of 5. To be a top-ranked institution, the average student score must be in the in the top 99% of classes. What average score is needed for the University to be a top ranked school?

   Below is R code for the problem that can be used to solve the problem.

```
qnorm(0.8, 0, 1)
```

```
## 0.842
```

```
qnorm(0.99, 0, 1)
```

```
## 2.326
```

```
pnorm(139, 99, 5)
```

```
## 1.000
```

```
pnorm(99, 139, 5)
```

```
## 0.000
```

   Solution
   The Z-score for the average students' scores are Z = `qnorm(0.99)` = 2.326. From the Z-score, we can calculate the LSAT score needed by solving $Z = \frac{\bar{x}-\mu}{\frac{\sigma}{\sqrt{n}}}$ for $\bar{x}$ getting $\bar{x} = Z * \frac{\sigma}{\sqrt{n}} + \mu = 2.326 * 5/4.583 + 139 = 141.538$.