CENG 3516 STATISTICAL COMPUTING
TEST YOURSELF FINAL

1. A study searches for the effect of caffeine consumption on sleep time. This study was conducted with a random sample of 10 students and their sleep hours were recorded on every Sundays for two weeks listed below. They requested not to consume coffee for the first week and they consumed coffee everyday for the second week.

1st week	8	10	9	11	8	7	9	10	9	9
2nd week	5	7	5	6	7	5	4	6	5	6

    a. Write down a hypothesis test if caffeine consumption affects sleep hours.

    b. Write down a hypothesis test if caffeine consumption affects sleep hours negatively.

    c. Test your hypothesis. (α=0.05)

    d. Test your hypothesis for 99% confidence level.

    e. Find the confidence intervals of mean sleep hours for these two weeks and compare them. (α=0.05)

2. The same experiment was conducted at another location with two independent groups of people. This time, sleep hours were recorded simultaneously in a week and 10 people were allocated to each group randomly.

1. group (Coffee -)	8	10	9	11	8	7	9	10	9	9
2. group (Coffee +)	5	7	5	6	7	5	4	6	5	6

a. Write down a hypothesis testing if caffeine consumption affects sleep hours.

b. Write down a hypothesis testing if caffeine consumption affects sleep hours negatively.

c. Test your hypothesis. ($\alpha=0.05$)

d. Test your hypothesis for 99% confidence level.

e. Find the confidence intervals of mean difference between these two groups and evaluate it. ($\alpha=0.05$)

3. Suppose we add another group to the groups in the second question. This group includes 10 people that consume coffee in only two days of this week. Complete the following outputs and compare these three groups.

Coffee +-	6	7	5	5	7	5	3	6	6	6

   a. Complete the following ANOVA output and evaluate if these groups have equal means or not. (α=0.05)

```
                Df    Sum Sq   Mean  Sq   F value   Pr(>F)
group
Residuals


Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

   a. Complete the following TukeyHSD output and compare the groups. (α=0.05)

```
  Tukey multiple comparisons of means
    95% family-wise confidence level
$grup
    diff        lwr        upr p adj
2-1  3.4             4.622137 6e-07
3-1  0.0 -1.222137           1e+00
2-3      -4.622137 -2.177863 6e-07
```

4. Let x and y are random variables calculated as follows:
   ```
   x <- runif(100, 0, 10)
   y <- 2 + 3*x + rnorm(100)
   ```
   Use these two variables to create a regression model.

a. Complete the following correlation output and evaluate the relationship and the significance of the correlation coefficient.

```
    Pearson's product-moment correlation
data:  x and y
t =……………… df = ……………, p-value ………………………
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
………………………………………………………
sample estimates:
     cor


```

b. Complete the following regression output and evaluate the significance of the coefficients.

```
Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)   ………………    ……………     ……………    …………………
x             ………………    ……………     ……………    …………………
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
Residual standard error: 0.9978 on 98 degrees of freedom
Multiple R-squared: 0.9848,     Adjusted R-squared: 0.9846
F-statistic:  6334 on 1 and 98 DF,  p-value: < 2.2e-16
```

c. Write down the regression model.