ASSIGNMENT THREE

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Question one

```
## Analysis of Variance Table
##
## Response: avg_eval
##           Df  Sum Sq Mean Sq F value  Pr(>F)
## age        1  0.0129 0.01291  0.0653 0.79884
## beauty     1  0.7890 0.78902  3.9921 0.04873 *
## female     1  1.1842 1.18424  5.9917 0.01631 *
## Residuals 90 17.7883 0.19765
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Model components are age, beauty and female. Total sum of squared error for model components $\mathrm{SS_{Model}}$ is 1.9861. The total sum of sqaured error for error component $\mathrm{SS_{Error}}$ is 17.7883. The degrees of freedom for model components $\mathrm{df_{Model}}$ is 3. The degree of freedom for error components $\mathrm{df_{Errorl}}$ is 90.

Question two

The MS model is

$$
\begin{aligned}
\mathrm{MS_{Model}} &= \frac{\mathrm{SS_{Model}}}{\mathrm{df_{Model}}} \\
&= \frac{0.0129 + 0.78902 + 1.1842}{1 + 1 + 1} \\
&= \frac{1.9861}{3} \\
&= 0.6620333
\end{aligned}
$$

THE MS error is

$$
\begin{aligned}
\mathrm{MS_{Error}} &= \frac{\mathrm{SS_{Error}}}{\mathrm{df_{Error}}} \\
&= \frac{17.7883}{90} \\
&= 0.1976478
\end{aligned}
$$

Question three

The observed F statistic

$$
\begin{aligned}
F &= \frac{\mathrm{MS_{Model}}}{\mathrm{MS_{Error}}} \\
&= \frac{0.6620333}{0.1976478} \\
&= 3.349561
\end{aligned}
$$

Question four

The computation using the cumulative density function, `pf()`, to obtain the p-value is:

```
## [1] 0.02251112
```

In our case this p-value is 0.02251112. It suggests that the observed F-value we obtained of 3.349561 is highly unlikely under the assumption that the null hypothesis that $\rho^2 = 0$ is true.

Question five

Components	Df	SumSq	MeanSq	F	p
Model	3	1.9861	0.6620330	3.349561	0.02251112
Error	90	17.7883	0.1976478		

Question six

```
## # A tibble: 4 x 5
##    term         estimate std.error statistic  p.value
##    <chr>           <dbl>     <dbl>     <dbl>    <dbl>
## 1 (Intercept)  4.00        0.246     16.3    1.50e-28
## 2 age          0.0000818   0.00486    0.0168 9.87e- 1
## 3 beauty       0.134       0.0597     2.24   2.74e- 2
## 4 female      -0.234       0.0956    -2.45   1.63e- 2
```

$$t = \frac{0.0000818}{0.00486} = 0.0168$$

Question seven

```
2 * pt(q = -0.0168, df = 90)
```

```
## [1] 0.9866334
```

In our case this p-value is 0.9866334 which is greater than 0.05. It suggests that the observed t-value we obtained of 0.0168 is highly likely under the assumption that the null hypothesis that $\beta_{age}=0$ is true
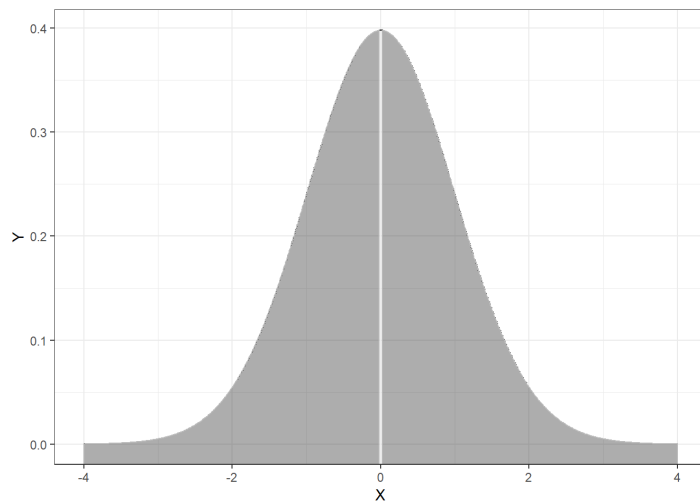
Question eight

Figure 01: Plot of the probability density function (PDF) of the t distribution and and the cumulative density associated with p value under this distribution.

Question nine

```
## [1] -1.986675  1.986675
```

The absolute value of the quantile of the t disctribution is 1.986675 that is associated with the 2.5th percentile

Question ten

```
## [1] -0.009658803
```

```
## [1] 0.009658803
```

The 95% confident interval for age is between -0.009658803 and 0.009658803. At 2.5%, the value for age is -0.009658803 and at 97.5%, the value for age is 0.009658803