

# Assignment 3

anonymous

## 1 General information

## 2 Inference for normal mean and deviation (3 points)

Loading the library and the data.

```
data("windshields1")  
# The data are now stored in the variable `windshields1`.  
# The below displays the data:  
windshields1
```

```
[1] 13.357 14.928 14.896 15.297 14.820 12.067 14.824 13.865 17.447
```

The below data is **only for the tests**, you need to change to the full data `windshields1` when reporting your results.

```
windshields_test <- c(13.357, 14.928, 14.896, 14.820)
```

### 2.1 (a)

Write your answers here!

### 2.2 (b)

Write your answers and code here!

Keep the below name and format for the functions to work with `markmyassignment`:

```
# Useful functions: mean(), length(), sqrt(), sum()  
# and qtnew(), dtnew() (from aaltobda)  
  
mu_point_est <- function(data) {  
  # Do computation here, and return as below.  
  # This is the correct return value for the test data provided above.  
  14.5  
}  
  
mu_interval <- function(data, prob = 0.95) {  
  # Do computation here, and return as below.
```

```
# This is the correct return value for the test data provided above.
c(13.3, 15.7)

}
```

You can plot the density as below if you implement `mu_pdf` to compute the PDF of the posterior  $p(\mu|y)$  of the average hardness  $\mu$ .

```
mu_pdf <- function(data, x){
  # Compute necessary parameters here.
  # These are the correct parameters for `windshields_test`
  # with the provided uninformative prior.
  df = 3
  location = 14.5
  scale = 0.3817557
  # Use the computed parameters as below to compute the PDF:

  dtnew(x, df, location, scale)
}

x_interval = mu_interval(windshields1, .999)
lower_x = x_interval[1]
upper_x = x_interval[2]
x = seq(lower_x, upper_x, length.out=1000)
plot(
  x, mu_pdf(windshields1, x), type="l",
  xlab=TeX(r'(average hardness $\mu$)'),
  ylab=TeX(r'(PDF of the posterior $p(\mu|y)$')')
)
```



Figure 1: PDF of the posterior  $p(\mu|y)$  of the average hardness  $\mu$

## 2.3 (c)

Write your answers and code here!

Keep the below name and format for the functions to work with markmyassignment:

```
# Useful functions: mean(), length(), sqrt(), sum()
# and qtnew(), dtnew() (from aaltobda)

mu_pred_point_est <- function(data) {
  # Do computation here, and return as below.
  # This is the correct return value for the test data provided above.
  14.5
}

mu_pred_interval <- function(data, prob = 0.95) {
  # Do computation here, and return as below.
  # This is the correct return value for the test data provided above.
  c(11.8, 17.2)
}
```

You can plot the density as below if you implement `mu_pred_pdf` to compute the PDF of the posterior predictive  $p(\tilde{y}|y)$  of a new hardness observation  $\tilde{y}$ .

```
mu_pred_pdf <- function(data, x){
  # Compute necessary parameters here.
  # These are the correct parameters for `windshields_test`
  # with the provided uninformative prior.
  df = 3
  location = 14.5
  scale = 0.8536316
  # Use the computed parameters as below to compute the PDF:

  dtnew(x, df, location, scale)
}

x_interval = mu_pred_interval(windshields1, .999)
lower_x = x_interval[1]
upper_x = x_interval[2]
x = seq(lower_x, upper_x, length.out=1000)
plot(
  x, mu_pred_pdf(windshields1, x), type="l",
  xlab=TeX(r'(new hardness observation $\tilde{y}$)'),
  ylab=TeX(r'(PDF of the posterior predictive $p(\tilde{y}|y)$')')
)
```



Figure 2: PDF of the posterior predictive  $p(\tilde{y}|y)$  of a new hardness observation  $\tilde{y}$

### 3 Inference for the difference between proportions (3 points)

#### 3.1 (a)

Write your answers here!

#### 3.2 (b)

Write your answers and code here!

The below data is **only for the tests**:

```
set.seed(4711)
no_samples = 1000
p0 = rbeta(no_samples, 5, 95)
p1 = rbeta(no_samples, 10, 90)
```

Keep the below name and format for the functions to work with markmyassignment:

```
# Useful function: mean(), quantile()

posterior_odds_ratio_point_est <- function(p0, p1) {
  # Do computation here, and return as below.
  # This is the correct return value for the test data provided above.
  2.650172
}

posterior_odds_ratio_interval <- function(p0, p1, prob = 0.95) {
```

```
# Do computation here, and return as below.  
# This is the correct return value for the test data provided above.  
c(0.6796942, 7.3015964)  
  
}
```

### 3.3 (c)

Write your answers and code here!

## 4 Inference for the difference between normal means (3 points)

Loading the library and the data.

```
data("windshieldsy2")  
# The new data are now stored in the variable `windshieldsy2`.  
# The below displays the first few rows of the new data:  
head(windshieldsy2)
```

```
[1] 15.980 14.206 16.011 17.250 15.993 15.722
```

### 4.1 (a)

Write your answers here!

### 4.2 (b)

Write your answers and code here!

```
# Useful functions: mean(), length(), sqrt(), sum(),  
# rtnew() (from aaltobda), quantile() and hist().
```

### 4.3 (c)

Write your answers here!