IT2120 - Probability and Statistics

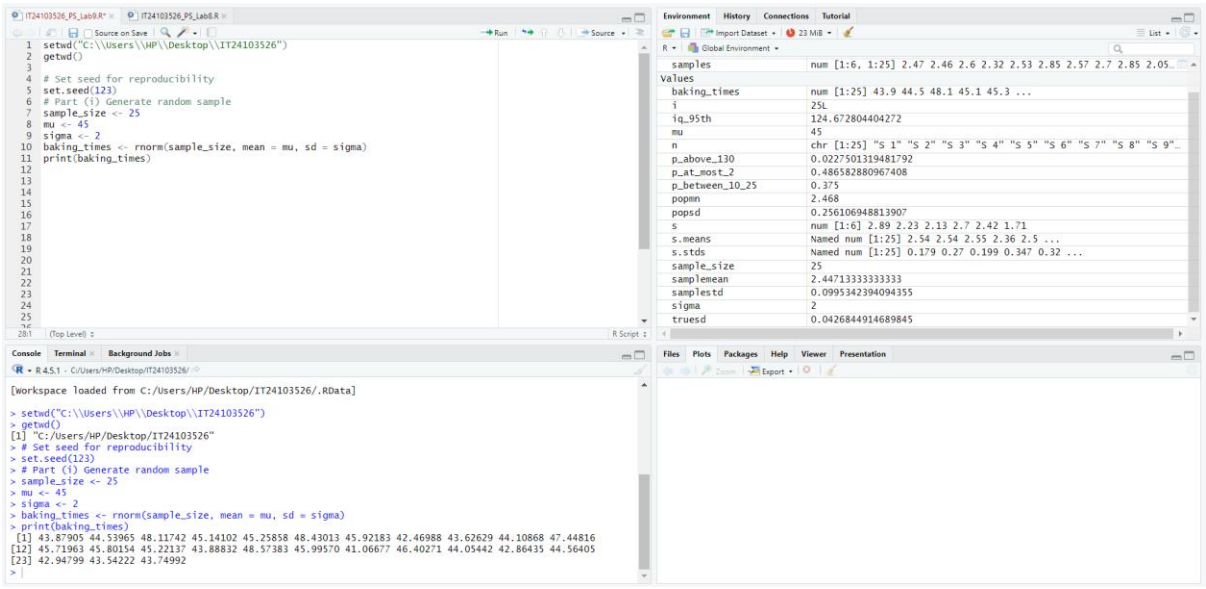
Lab Sheet 09

IT24103526 - Senaratne P.A.R.T.

Exercise

1. Assume that the time taken to bake a batch of cookies is normally distributed with mean 45 minutes and standard deviation 2 minutes.

    i. Generate a random sample of size 25 for the baking time.

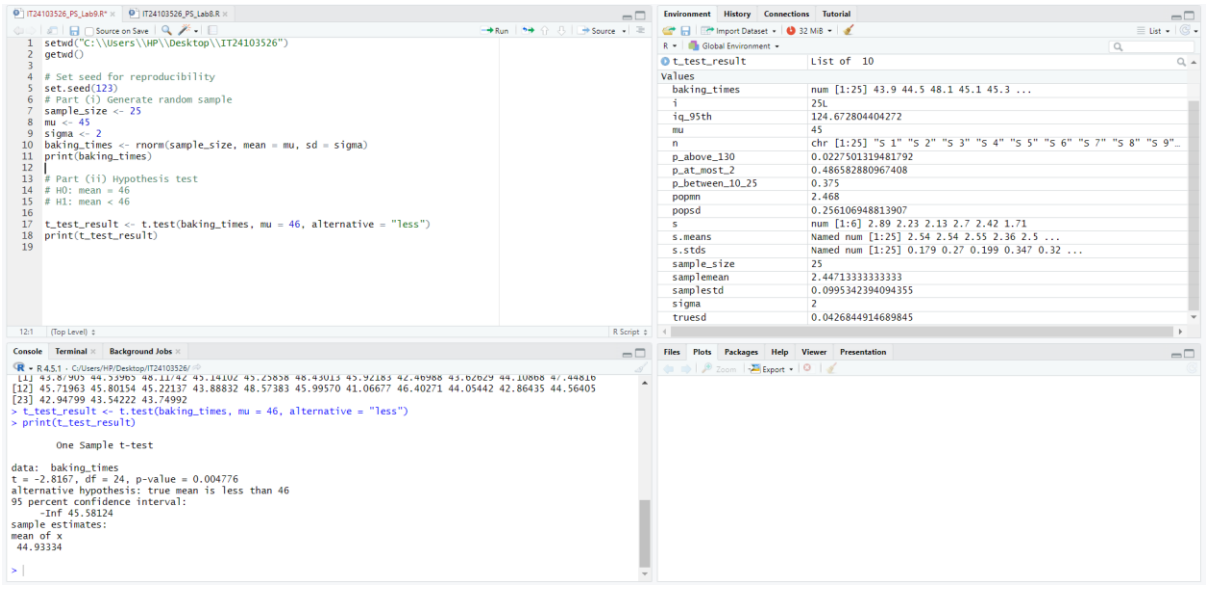


```
setwd("C:\\Users\\HP\\Desktop\\IT24103526")
getwd()

# Set seed for reproducibility
set.seed(123)
# Part (i) Generate random sample
sample_size <- 25
mu <- 45
sigma <- 2
baking_times <- rnorm(sample_size, mean = mu, sd = sigma)
print(baking_times)
```

```
[Workspace loaded from C:/Users/HP/Desktop/IT24103526/.RData]

> setwd("C:\\Users\\HP\\Desktop\\IT24103526")
> getwd()
[1] "C:/Users/HP/Desktop/IT24103526"
> # Set seed for reproducibility
> set.seed(123)
> # Part (i) Generate random sample
> sample_size <- 25
> mu <- 45
> sigma <- 2
> baking_times <- rnorm(sample_size, mean = mu, sd = sigma)
> print(baking_times)
 [1] 43.87905 44.53965 48.11742 45.14102 45.25858 48.43013 45.92183 42.46988 43.62629 44.10868 47.44816
[12] 45.71963 45.80154 45.22137 43.88832 48.57383 45.99570 41.06677 46.40271 44.05442 42.86435 44.56405
[23] 42.94799 43.54222 43.74992
>
```

Values	
samples	num [1:6, 1:25] 2.47 2.46 2.6 2.32 2.53 2.85 2.57 2.7 2.85 2.05...
baking_times	num [1:25] 43.9 44.5 48.1 45.1 45.3 ...
i	25L
iq_95th	124.672804404272
mu	45
n	chr [1:25] "S 1" "S 2" "S 3" "S 4" "S 5" "S 6" "S 7" "S 8" "S 9"...
p_above_130	0.0227501319481792
p_at_most_2	0.486582880967408
p_between_10_25	0.375
popmn	2.468
popsd	0.256106948813907
s	num [1:6] 2.89 2.23 2.13 2.7 2.42 1.71
s.means	Named num [1:25] 2.54 2.54 2.55 2.36 2.5 ...
s.stds	Named num [1:25] 0.179 0.27 0.199 0.347 0.32 ...
sample_size	25
samplemean	2.44713333333333
samplestd	0.0995342394094355
sigma	2
truesd	0.0426844914689845

    ii. Test whether the average baking time is less than 46 minutes at a 5% level of significance.



```
setwd("C:\\Users\\HP\\Desktop\\IT24103526")
getwd()

# Set seed for reproducibility
set.seed(123)
# Part (i) Generate random sample
sample_size <- 25
mu <- 45
sigma <- 2
baking_times <- rnorm(sample_size, mean = mu, sd = sigma)
print(baking_times)

# Part (ii) Hypothesis test
# H0: mean = 46
# H1: mean < 46

t_test_result <- t.test(baking_times, mu = 46, alternative = "less")
print(t_test_result)
```

```
 [1] 43.87905 44.53965 48.11742 45.14102 45.25858 48.43013 45.92183 42.46988 43.62629 44.10868 47.44816
[12] 45.71963 45.80154 45.22137 43.88832 48.57383 45.99570 41.06677 46.40271 44.05442 42.86435 44.56405
[23] 42.94799 43.54222 43.74992
> t_test_result <- t.test(baking_times, mu = 46, alternative = "less")
> print(t_test_result)

        One Sample t-test

data:  baking_times
t = -2.8167, df = 24, p-value = 0.004776
alternative hypothesis: true mean is less than 46
95 percent confidence interval:
     -Inf 45.58124
sample estimates:
mean of x
 44.93334

>
```

Values	
t_test_result	List of 10
baking_times	num [1:25] 43.9 44.5 48.1 45.1 45.3 ...
i	25L
iq_95th	124.672804404272
mu	45
n	chr [1:25] "S 1" "S 2" "S 3" "S 4" "S 5" "S 6" "S 7" "S 8" "S 9"...
p_above_130	0.0227501319481792
p_at_most_2	0.486582880967408
p_between_10_25	0.375
popmn	2.468
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sample_size	25
samplemean	2.44713333333333
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