# PS1

Applied Stats 1

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## Question 1

Section 1

Since number of observations = 25 which is smaller than 30, we will use a t-distribution with df = 24 to calculate confidence interval. We calculate the sample mean, sampling error and t-value to construct the CI.

```
#Load data
y <- c(105, 69, 86, 100, 82, 111, 104, 110, 87, 108, 87, 90, 94, 113, 112, 98,
    80, 97, 95, 111, 114, 89, 95, 126, 98)
#Calculate lower and upper bound of confidence interval
sampling_mean <- mean(y)
sampling_sd <- sd(y)/sqrt(25)
t_value <- qt((1-0.9)/2 ,lower.tail = FALSE, df = 25 -1 )
CI <- c(sampling_mean - t_value*sampling_sd, sampling_mean + t_value*sampling_
    sd )
```

We have the result for 90% CI

```
93.95993 102.92007
```

Section 2

We follow the 5 step of hypothesis testing:

Step 1: Our assumption is that that the data is randomly selected, the sample is relatively small ($25 < 30$) and the data is quantitative. And according the the question, this will be an one-sided t-test

Step 2: Setting null and alternative hypothesis
$H_0$: The school mean $IQ = 100$

$H_a$: The school mean $IQ > 100$

Step 3: Calculating test statistics

```
sample_mean <- mean(y)

#calculate t-statistic
t = (sample_mean - 100)/(sd(y)/sqrt(25))
```

We have t = -0.596

Step 4: Calculating p-value (in the direction of the alternative hypothesis)

```
#calculae p-val
pt(t,df = 24,lower.tail = FALSE)
```

We have p-value = 0.72 which is much larger than 0.05.

Step 5: Conclusion
We do not have enough evidence to reject the null hypothesis that the school student's mean IQ = 100

# Question 2

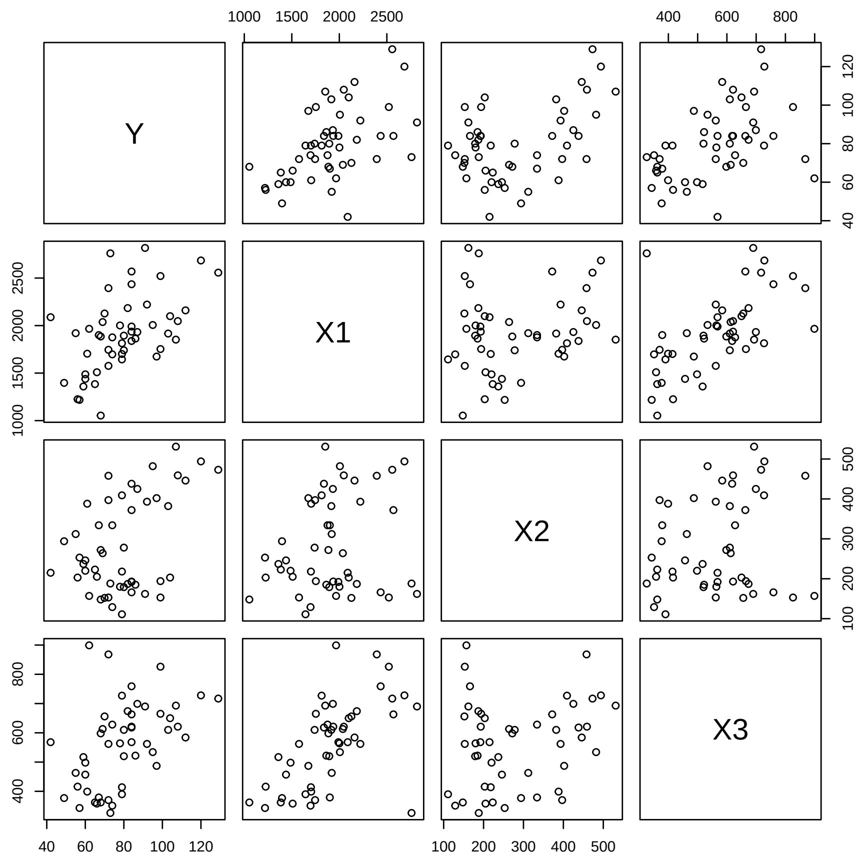
Section 1
We create scatterplot pairwise and examine variables relationship

```
expenditure <- read.table("https://raw.githubusercontent.com/ASDS-TCD/StatsI_Fall2024/main/datasets/expenditure.txt", header=T)
# scatter plot of X1,X2,X3,Y pairwise
pdf("/Users/tpminh/Desktop/trinity asds/stat analysis 1/ps1/pairplot.pdf")
pairs(expenditure[2:5])
dev.off()
```

As seen from Figures 1:

- X1 and Y seem to be positively correlated, as X1 increases, Y generally increases
- X2 and Y do not seem to be correlated, as X2 increase, some observations have Y increase, while others have Y decrease
- X3 and Y seem to be positively correlated
- X1 and X2 do not seem to be correlated
- X1 and X3 seem to be positively correlated
- X2 and X3 do not seem to be correlated

Figure 1: Scatterplot between variables.




Section 2

We use boxplot to examine relationship between Y and Region

```
pdf("/Users/tpminh/Desktop/trinity asds/stat analysis 1/ps1/boxplot.pdf")
boxplot(expenditure$Y ~ expenditure$Region)
dev.off()
```

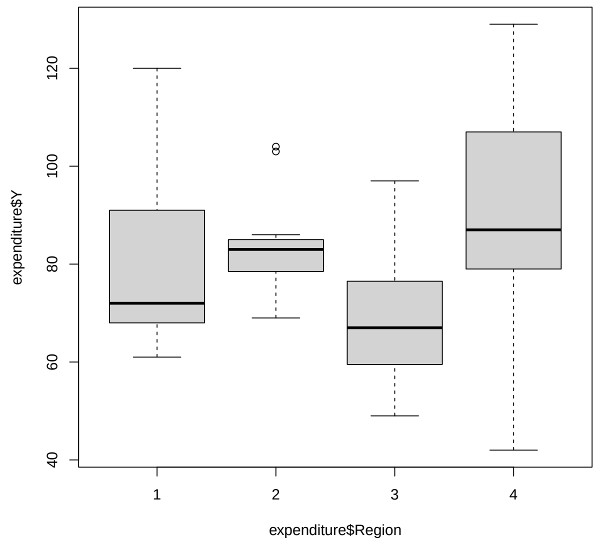
We can see that Region 4 has the highest average expenditures from Figures 2. But just to be sure, lets calculate the actual average of each region

```
aggregate(list(avg_exp = expenditure$Y), list(Region = expenditure$Region),
    FUN=mean)
```

Which give the result:

```
  Region  avg_exp
1      1 79.44444
2      2 83.91667
3      3 69.18750
```

Figure 2: Boxplot of expeniture by region.




```
4        4 88.30769
```

In conclusion Region 4 have he highest average expenditure of 88.3

Section 3

Lets examine relationship between Y and X1

```r
plot( expenditure$X1,expenditure$Y)
```

As we have examined in the previous section, Y and X1 seem to be positively correlated (Figure 3). As X1 increase, Y will generally increase. Figure 4 changes the colour and symbol of scatterplot

```r
plot( expenditure$X1,expenditure$Y, col = expenditure$Region, pch =
   expenditure$Region)
```

Figure 3: Scatterplot between X1 and Y.

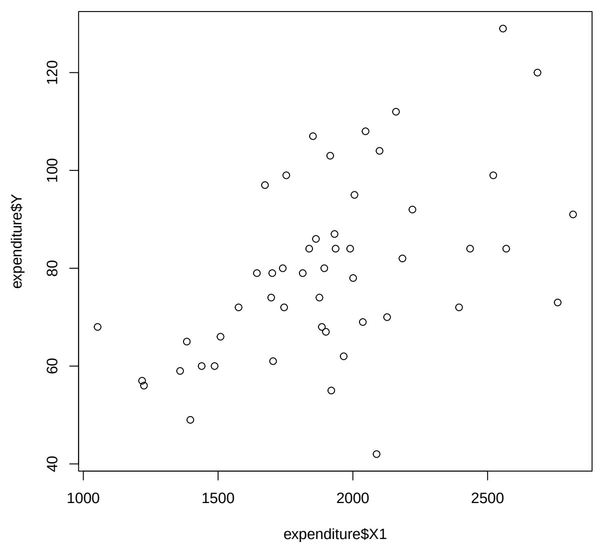



Figure 4: Scatterplot between X1 and Y with new colour and symbol.