GROUP 3

Thành viên

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Ex2:

On a:

X_{i1}	X_{i2}	Y_i
4	4.0	37.8
4	3.6	22.5
3	3.1	17.1
2	3.2	10.8
1	3.0	7.2
6	3.8	42.3
4	3.8	30.2
4	2.9	19.4
1	3.8	14.8
1	2.8	9.5
3	3.4	32.4
4	2.8	21.6

1/ Le pourcentage de variation dans la résistance à la rupture est :

Y en fonction de l'épaisseur X_1 :

$R^2 = \frac{SC_{reg}}{SC_{tot}} = \frac{980,64}{980,64 + 440,03} = 0,6903$ => Le pourcentage de variation est 69.03%

Y en fonction de la densité X_2 :

$R^2 = \frac{SC_{reg}}{SC_{tot}} = \frac{643,57}{643,57+777,10} = 0,453$ => Le pourcentage de variation est 45,3%

Y en fonction de l'épaisseur X_1 et de la densité X_2 :

$R^2 = \frac{SC_{reg}}{SC_{tot}} = \frac{1204,86}{1204,86+215,81} = 0,8481$ => Le pourcentage de variation est 84,81%

2/

	Carré moyen résiduel	Écart-type des résidus
Regression due à X_1	$\frac{SC_{reg}}{p-1} = \frac{440.03}{12-2}$ = 44.003	$s = \sqrt{\frac{SC_{res}}{n-p}} = \sqrt{\frac{440.03}{12-2}}$ = 6,6335
Regression due à X_2	$\frac{SC_{reg}}{p-1} = \frac{777.10}{12-2}$ = 77.71	$s = \sqrt{\frac{SC_{res}}{n-p}} = \sqrt{\frac{777.10}{12-2}}$ = 8,815
Regression due à (X_1, X_2)	$\frac{SC_{reg}}{p-1} = \frac{215.81}{12-3}$ = 23.979	$s = \sqrt{\frac{SC_{res}}{n-p}} = \sqrt{\frac{215.81}{12-3}}$ = 4,8968

3/

Source de variation	Somme de carrés	ddl	Carrés moyens	Fobs
Regression due à (X_1, X_2)	1204.86	p - 1 = 2	$\frac{SC_{reg}}{p-1} = \frac{1204,86}{2}$ = 602.43	25.12335
Residuelle	215.81	n - p = 9	$\frac{SC_{reg}}{p-1} = \frac{215.81}{9}$ = 23.97889	
Totale	1420.67	n - 1 = 11		

4/

On a la valeur critique: $F_{(\alpha, r, n-p)} = F_{(0.05, 2, 9)}$ = 4.26 (utiliser le tableau Fisher)

$F_{obs} = \frac{MC_{reg}}{MC_{res}} = \frac{602.43}{23.97889}$ = 25.12335 > 4.26

⇨ Alors on rejete H_0 au seuil de signification α = 0,05

5/ $[\beta_1 - t_{\alpha/2, n-p} \times s(\hat{\beta}_1); \beta_1 + t_{\alpha/2, n-p} \times s(\hat{\beta}_1)]$ = [6.036 - 2.228*1.279, 6.036 + 2.228*1.279]

= [3.186388, 8.885612]

==========CODE R==========

EX2_TP2.r

Admin

2020-04-23

```
Yi = c(37.8, 22.5, 17.1, 10.8, 7.2, 42.3, 30.2, 19.4, 14.8, 9.5, 32.4,21.6)
```

```r
X1 <- c(4,4,3,2,1,6,4,4,1,1,3,4)
X2 <- c(4.0,3.6,3.1,3.2,3.0,3.8,3.8,2.9,3.8,2.8,3.4,2.8)

droite_X1<-lm(Yi~X1)
droite_X2<-lm(Yi~X2)
droite<-lm(Yi~X1+X2)

###Q1
summary(droite_X1) #Y en fonction X1 - pourcentage: 69.03 %
##
## Call:
## lm(formula = Yi ~ X1)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -8.266 -4.887 -1.208  3.232 10.770
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)    3.523      4.383   0.804 0.440237
## X1             6.036      1.279   4.721 0.000816 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 6.633 on 10 degrees of freedom
## Multiple R-squared:  0.6903, Adjusted R-squared:  0.6593
## F-statistic: 22.29 on 1 and 10 DF,  p-value: 0.0008155
summary(droite_X2)#Y en fonction X2 - pourcentage: 45.3 %
##
## Call:
## lm(formula = Yi ~ X2)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -15.1923  -5.1780  -0.2298   6.1123  12.3077
##
## Coefficients:
```

```
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  -36.373     20.489  -1.775   0.1062
## X2            17.464      6.069   2.878   0.0164 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 8.815 on 10 degrees of freedom
## Multiple R-squared:  0.453,  Adjusted R-squared:  0.3983
## F-statistic: 8.282 on 1 and 10 DF,  p-value: 0.01645
summary(droite) #Y en fonction X1+X2 - pourcentage: 84.81 %
##
## Call:
## lm(formula = Yi ~ X1 + X2)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -6.897 -2.135 -1.126  1.714 10.122
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  -30.081     11.455  -2.626 0.027542 *
## X1             4.905      1.014   4.838 0.000923 ***
## X2            11.072      3.621   3.058 0.013617 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 4.897 on 9 degrees of freedom
## Multiple R-squared:  0.8481, Adjusted R-squared:  0.8143
## F-statistic: 25.12 on 2 and 9 DF,  p-value: 0.0002075
##Q2
anova(droite_X1)
## Analysis of Variance Table
##
## Response: Yi
##           Df Sum Sq Mean Sq F value    Pr(>F)
## X1         1 980.63  980.63  22.285 0.0008155 ***
## Residuals 10 440.03   44.00
```

```
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
summary(droite_X1)
##
## Call:
## lm(formula = Yi ~ X1)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -8.266 -4.887 -1.208  3.232 10.770
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)    3.523      4.383   0.804 0.440237
## X1             6.036      1.279   4.721 0.000816 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 6.633 on 10 degrees of freedom
## Multiple R-squared:  0.6903, Adjusted R-squared:  0.6593
## F-statistic: 22.29 on 1 and 10 DF,  p-value: 0.0008155
#CMres = 44.00
#s = 6.633
#Regression due a X1:     440.03/(12-2)   sqrt((440.03)/(12-2))

anova(droite_X2)
## Analysis of Variance Table
##
## Response: Yi
##           Df Sum Sq Mean Sq F value  Pr(>F)
## X2         1 643.57  643.57  8.2816 0.01645 *
## Residuals 10 777.10   77.71
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
summary(droite_X2)
##
## Call:
```

```
## lm(formula = Yi ~ X2)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -15.1923  -5.1780  -0.2298   6.1123  12.3077
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  -36.373     20.489  -1.775   0.1062
## X2            17.464      6.069   2.878   0.0164 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 8.815 on 10 degrees of freedom
## Multiple R-squared:  0.453,  Adjusted R-squared:  0.3983
## F-statistic: 8.282 on 1 and 10 DF,  p-value: 0.01645
#CMres = 77.71
#s = 8.815
#Regression due a X2:     777.10/(12-2)   sqrt((777.10)/(12-2))

anova(droite)
## Analysis of Variance Table
##
## Response: Yi
##           Df Sum Sq Mean Sq F value   Pr(>F)
## X1         1 980.63  980.63 40.8959 0.000126 ***
## X2         1 224.22  224.22  9.3509 0.013617 *
## Residuals  9 215.81   23.98
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
summary(droite)
##
## Call:
## lm(formula = Yi ~ X1 + X2)
##
## Residuals:
##    Min     1Q Median     3Q    Max
```

```
## -6.897 -2.135 -1.126  1.714 10.122
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  -30.081     11.455  -2.626 0.027542 *
## X1             4.905      1.014   4.838 0.000923 ***
## X2            11.072      3.621   3.058 0.013617 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 4.897 on 9 degrees of freedom
## Multiple R-squared:  0.8481, Adjusted R-squared:  0.8143
## F-statistic: 25.12 on 2 and 9 DF,  p-value: 0.0002075
#s = 4.897
#CMres = 23.98
#Regression due a X1,X2:  215.81/(12-3)   sqrt((215.81)/(12-3))


##Q3
anova(droite)
## Analysis of Variance Table
##
## Response: Yi
##           Df Sum Sq Mean Sq F value   Pr(>F)
## X1         1 980.63  980.63 40.8959 0.000126 ***
## X2         1 224.22  224.22  9.3509 0.013617 *
## Residuals  9 215.81   23.98
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
summary(droite)
##
## Call:
## lm(formula = Yi ~ X1 + X2)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -6.897 -2.135 -1.126  1.714 10.122
##
```

```
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  -30.081     11.455  -2.626 0.027542 *
## X1             4.905      1.014   4.838 0.000923 ***
## X2            11.072      3.621   3.058 0.013617 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 4.897 on 9 degrees of freedom
## Multiple R-squared:  0.8481, Adjusted R-squared:  0.8143
## F-statistic: 25.12 on 2 and 9 DF,  p-value: 0.0002075
#Regression due a X1,X2:  1204.86   2   602.43   25.12335
#Residuelle            :  215.81    9   23.97889
#Totale                :  1420.67   11

##Q4
summary(droite)
##
## Call:
## lm(formula = Yi ~ X1 + X2)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -6.897 -2.135 -1.126  1.714 10.122
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  -30.081     11.455  -2.626 0.027542 *
## X1             4.905      1.014   4.838 0.000923 ***
## X2            11.072      3.621   3.058 0.013617 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 4.897 on 9 degrees of freedom
## Multiple R-squared:  0.8481, Adjusted R-squared:  0.8143
## F-statistic: 25.12 on 2 and 9 DF,  p-value: 0.0002075
qf(0.95,2,9)
```

```
## [1] 4.256495
#H0: beta1 = beta2 = 0
#On a Fobs = 25.12335 > 4.256495 => rejetter H0


##Q5: intervalle de confiance pour beta1
summary(droite_X1)
##
## Call:
## lm(formula = Yi ~ X1)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -8.266 -4.887 -1.208  3.232 10.770
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)    3.523      4.383   0.804 0.440237
## X1             6.036      1.279   4.721 0.000816 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 6.633 on 10 degrees of freedom
## Multiple R-squared:  0.6903, Adjusted R-squared:  0.6593
## F-statistic: 22.29 on 1 and 10 DF,  p-value: 0.0008155
confint(droite_X1)[2,]
##    2.5 %   97.5 %
## 3.187036 8.884790
#B0 : [-6.242858; 13.28806]
#B1 : [3.187036 ; 8.88479 ]
```