R

将数据输入 R

```
male_height<-c(185, 173, 175, 182, 173, 181, 184, 179, 181, 187, 169, 178,
 183, 168, 181, 175, 175, 186, 186, 182, 178, 177, 172, 168,
 173.5, 184, 183, 175, 168, 174, 181, 170, 166, 178, 177, 181,
 163, 172, 160, 173, 185, 172, 183, 180, 175, 178, 169, 175,
 165, 169, 170, 183, 184, 174, 170, 173, 170, 182, 178, 170,
 179)

male_weight<-c(65, 62, 80.3, 74.3, 55.7, 60, 59, 79, 62, 80, 56, 60.5,
 73, 46, 65, 91, 64, 88, 63, 64, 65, 75.6, 64, 65.5,
 58.8, 59, 71, 75, 60, 61, 75, 58, 56, 94.5, 87, 71,
 47.5, 59, 57, 65, 67, 60, 85, 65, 73, 70, 55, 75,
 55, 65, 65, 72, 99, 75, 53, 70, 58, 63, 92, 48,
 69)

male_armspan<-c(188, 182, 183, 189, 185, 170, 179, 165, 171, 196, 168, 177,
 179, 167, 175, 171, 170, 183, 180, 182, 180, 177, 176, 170,
 167, 179, 186, 168, 160, 171.5, 181, 172, 146, 177, 168, 183,
 162, 170.5, 166.7, 173, 176, 167, 188, 178, 178, 175, 169, 171,
 164, 175, 161, 174, 188, 171, 166.6, 171, 169, 160, 175, 164,
 169)

male_leglength<-c(102, 93, 107, 114, 107, 101, 98, 99, 98, 119, 97, 101,
 102, 99, 103, 97, 82, 101, 95, 97, 91, 95.5, 95, 82,
 83, 98, 98, 105, 93, 96.5, 104.5, 85, 77, 105, 94, 102,
 77, 95.8, 83.5, 89, 106, 98, 102, 93, 98, 90, 86, 98,
 99, 99, 92, 100, 108, 102, 83, 101, 102, 80, 85, 92,
 98)

male_footlength<-c(25.1, 23.5, 26.5, 26, 26, 25, 26.5, 26, 26, 29, 26, 26.5,
 27, 24.5, 25.5, 22, 24, 28, 26.5, 26.5, 26.5, 27, 25, 25.5,
 24, 26.5, 26, 27, 22, 23.4, 25.5, 25.4, 22, 26.5, 22, 26,
 23.8, 23, 22.8, 25.5, 25.8, 24.5, 26.5, 24, 26.5, 29, 23, 26,
 22, 23, 22, 27.5, 26.5, 26, 20, 25.5, 24.5, 24, 25.5, 23,
 25)

female_height<-c(159, 172, 163, 165, 168, 165, 163, 165, 160, 158, 168, 162,
 161, 172, 168, 168, 174, 161, 162, 166, 162, 162, 170, 168,
```

```
159, 168, 164, 155, 166)

female_weight<-c(47.9, 54, 60, 53, 52, 53, 58.5, 55, 50, 46.5, 58, 46,
  51, 63, 66.5, 52, 56, 44, 57.5, 54.5, 53, 48, 60, 59,
  54.5, 68, 55, 42, 51)

female_armspan<-c(158.8, 173, 163, 164, 169, 166, 156, 165, 161, 152, 166, 148,
  152, 174, 162, 166, 179.5, 160, 164, 159, 160, 155, 169, 168,
  136.6, 149, 158, 155, 165)

female_leglength<-c(100, 105, 102, 97, 97.5, 94, 88, 94, 89, 92, 95, 90,
  91, 104, 99, 97, 105, 90, 88, 94, 94, 97, 104, 82,
  83, 100, 90, 85, 95)

female_footlength<-c(22.8, 23.5, 24, 22.6, 24.8, 21.5, 23.5, 23.5, 23, 22.5, 23.5, 21.4,
  22.6, 24.5, 24.5, 23.5, 24.5, 23, 24.3, 24, 24, 23, 24.5, 24,
  24.7, 23.5, 23.5, 25, 23)
```

1.1 总体描述（仅列出男生身高的输入命令和输出结果，其他类似）

```
> sort(male_height)

 [1] 160.0 163.0 165.0 166.0 168.0 168.0 168.0 169.0 169.0 169.0 170.0 170.0
[13] 170.0 170.0 170.0 172.0 172.0 172.0 173.0 173.0 173.0 173.0 173.5 174.0
[25] 174.0 175.0 175.0 175.0 175.0 175.0 175.0 177.0 177.0 178.0 178.0 178.0
[37] 178.0 178.0 179.0 179.0 180.0 181.0 181.0 181.0 181.0 181.0 182.0 182.0
[49] 182.0 183.0 183.0 183.0 183.0 184.0 184.0 184.0 185.0 185.0 186.0 186.0
[61] 187

> summary(male_height)

   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
  160.0   172.0   175.0   176.1   181.0   187.0

> var(male_height)

[1] 40.48197

> sd(male_height)

[1] 6.362544
```

1.2 绘制男生身高直方图

```
> hist(male_height, breaks=160+(0:9)*3,
+ xlim=c(min(male_height),max(male_height)), col='lightblue')
```

1.3 绘制男生身高经验分布函数

```
> x <- sort(male_height)
> n <- length(x)
> y <- (1:n)/n
> m <- mean(male_height)
> s <- sd(male_height)
> plot(x,y, type='s', main="empirical cdf of male_height")
```

2.1 方差未知时均值区间估计（仅列出男生身高的输入命令和输出结果，其他类似）

```
>   t.test(male_height)

        One Sample t-test

data:   male_height
t = 216.14, df = 60, p-value < 2.2e-16
alternative hypothesis: true mean is not equal to 0
95 percent confidence interval:
 174.4442 177.7033
sample estimates:
mean of x
 176.0738
```

2.2 均值未知时方差区间估计（仅列出男生身高的输入命令和输出结果，其他类似）

```
> interval_var1<-function(x,mu=Inf,alpha=0.05){
+ n<-length(x)
+ if (mu<Inf){
+ S2 <- sum((x-mu)^2)/n; df <- n
+ }
+ else{
+ S2 <- var(x); df <- n-1
+ }
+ a<-df*S2/qchisq(1-alpha/2,df)
+ b<-df*S2/qchisq(alpha/2,df)
+ data.frame(var=S2, df=df, a=a, b=b)
```

```
+ }
> interval_var1(male_height)

       var df        a        b
1 40.48197 60 29.15949 60.00032
```

3.1 绘制 QQ 图

```
> qqnorm(male_height,
+ main="Normality Check via QQ Plot")
> qqline(male_height, col='red')
```

3.2 与正态分布密度函数比较

```
dens <- density(male_height)
xlim <- range(dens$x); ylim<-range(dens$y)
hist(male_height,breaks=160+(0:9)*3,
xlim=xlim,ylim=ylim,
probability=T)

lines(dens,col=par('fg'),lty=2)
m <- mean(male_height)

s <- sd(male_height)
curve( dnorm(x, m, s), col='red', add=T)
hist(male_height,breaks=160+(0:9)*3,
xlim=xlim,ylim=ylim,
probability=T)

lines(dens,col=par('fg'),lty=2)
m <- mean(male_height)
s <- sd(male_height)
curve( dnorm(x, m, s), col='red', add=T)
```

3.3 经验分布函数与正态分布函数比较

```
> x <- sort(male_height)
> n <- length(x)
> y <- (1:n)/n
> m <- mean(male_height)
> s <- sd(male_height)
> plot(x,y, type='s', main="empirical cdf of ")
> curve(pnorm(x,m,s),col='red', lwd=2, add=T)
```

3.4 方差未知时检验均值

```
> t.test(male_height, mu=171.9)

        One Sample t-test

data:   male_height
t = 5.1235, df = 60, p-value = 3.36e-06
alternative hypothesis: true mean is not equal to 171.9
95 percent confidence interval:
 174.4442 177.7033
sample estimates:
mean of x
 176.0738
```

4.1 平方和的检验与分解

```
X<-c(185, 173, 175, 182, 173, 181, 184, 179, 181, 187, 169, 178,
 183, 168, 181, 175, 175, 186, 186, 182, 178, 177, 172, 168,
 173.5, 184, 183, 175, 168, 174, 181, 170, 166, 178, 177, 181,
 163, 172, 160, 173, 185, 172, 183, 180, 175, 178, 169, 175,
 165, 169, 170, 183, 184, 174, 170, 173, 170, 182, 178, 170,
 179,
 159, 172, 163, 165, 168, 165, 163, 165, 160, 158, 168, 162,
 161, 172, 168, 168, 174, 161, 162, 166, 162, 162, 170, 168,
 159, 168, 164, 155, 166)
A<-factor(c(rep(1,61),   rep(2,29)) )
miscellany<-data.frame(X, A)
aov.mis<-aov(X~A, data=miscellany)
summary(aov.mis)

            Df Sum Sq Mean Sq F value    Pr(>F)
A            1   2578  2578.3   75.44 1.82e-13 ***
Residuals   88   3008    34.2
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

4.2 绘图

```
> plot(miscellany$X~miscellany$A)
```

5.1 绘制散点图

```
> level <- data.frame(male_weight, male_height)
> plot(level)
```

5.2 男生身高、体重的相关分析

```
> attach(level)
> cor.test(male_weight, male_height)

        Pearson's product-moment correlation

data:  male_weight and male_height
t = 4.5635, df = 59, p-value = 2.601e-05
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 0.2971703 0.6756816
sample estimates:
      cor
0.5107684
```

5.3 男生体重与身高的β0，β1 的估计与显著性检验

```
lm.reg<-lm(male_height~1+male_weight)
summary(lm.reg)

Call:
lm(formula = male_height ~ 1 + male_weight)

Residuals:
     Min       1Q   Median       3Q      Max
-13.1839  -3.8232  -0.9416   4.1378  11.1364

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) 157.22710    4.18987  37.526  < 2e-16 ***
male_weight   0.27994    0.06134   4.563  2.6e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 5.516 on 59 degrees of freedom
Multiple R-squared:  0.2609,    Adjusted R-squared:  0.2484
F-statistic: 20.83 on 1 and 59 DF,  p-value: 2.601e-05
```

5.4 画出回归方程的直线

```
abline(lm.reg)
```

5.5β0，β1 的区间估计

```
confint(lm.reg, level=0.95)
```

```
                    2.5 %         97.5 %
(Intercept) 148.8431982 165.6110086
male_weight     0.1571935     0.4026948
```

5.6 计算残差和标准残差, 并画出相应的残差散点图

```
res<-residuals(lm.reg)
plot(res)
for(i in 1:61)
{text(i, res[i], labels=i, adj=(.05))}

res<-rstandard(lm.reg)
plot(res)
for(i in 1:61)
{text(i, res[i], labels=i, adj=(.05))}
```

5.7 影响分析

```
height<-data.frame(male_height, male_weight, male_armspan,
  male_leglength, male_footlength)
lm.reg<-lm(male_height~male_weight+male_armspan
+male_leglength+male_footlength, data=blood)
lm.step<-step(lm.reg)
summary(lm.step)
influence.measures(lm.reg)
```

最后一句命令的结果如下：

```
Influence measures of
         lm(formula = male_height ~ male_weight + male_armspan + male_leglength +         male_footlength, data = blood) :

       dfb.1_    dfb.ml_w    dfb.ml_r    dfb.ml_l dfb.ml_f     dffit cov.r     cook.d
1    -0.28362 -0.139347    3.66e-01 -0.021482 -0.20362    0.4327 1.057 3.70e-02
2       0.11743      0.066427  -2.85e-01       0.118043      0.20755  -0.3341  1.145 2.24e-02
3     0.20558 -0.147290 -4.98e-02 -0.164003    0.02763 -0.4360 0.837 3.63e-02
4     0.06737    0.013978 -4.38e-02 -0.064053    0.04300 -0.1131 1.233 2.60e-03
```

5	0.37499	0.479750	-2.90e-01	-0.249670	0.07470	-0.6695	0.898	8.57e-02
6	0.11077	-0.172490	-1.99e-01	0.269900	0.04887	0.4065	0.860	3.18e-02
7	-0.16136	-0.246137	1.03e-01	-0.032603	0.14620	0.3700	0.915	2.66e-02
8	0.17612	0.168512	-2.94e-01	0.100977	0.14567	0.3499	1.138	2.45e-02
9	0.05689	-0.110240	-1.55e-01	0.084180	0.17191	0.2981	0.940	1.74e-02
10	0.16678	0.027030	-5.79e-02	-0.093319	-0.02921	-0.2123	1.292	9.15e-03
11	-0.09989	0.190432	2.10e-01	-0.108040	-0.22194	-0.3725	0.998	2.73e-02
12	-0.00320	-0.007001	-6.56e-04	0.003086	0.00509	0.0112	1.150	2.55e-05
13	-0.05210	0.007088	-1.86e-02	0.020868	0.07620	0.1435	1.079	4.15e-03
14	-0.08084	0.255161	1.10e-01	-0.174761	-0.04085	-0.3383	1.128	2.29e-02
15	-0.01068	-0.068379	-4.90e-02	0.135452	0.01042	0.2039	1.021	8.29e-03
16	0.00426	0.011232	9.32e-05	0.000845	-0.00974	0.0147	1.396	4.41e-05
17	0.03880	0.023748	5.88e-02	-0.157960	-0.01082	0.1864	1.159	7.03e-03
18	-0.07240	0.120310	7.53e-04	-0.052674	0.08849	0.2053	1.162	8.52e-03
19	-0.22424	-0.191368	2.14e-01	-0.209856	0.16907	0.4638	0.796	4.07e-02
20	-0.09554	-0.066326	9.03e-02	-0.056601	0.03809	0.1581	1.106	5.05e-03
21	0.01547	0.007569	-1.94e-02	0.027368	-0.01299	-0.0384	1.179	3.00e-04
22	0.02338	-0.047197	1.12e-02	0.061629	-0.08626	-0.1426	1.112	4.11e-03
23	0.03404	0.049610	-7.93e-02	0.050016	0.02368	-0.1720	1.005	5.90e-03
24	-0.09378	-0.067342	-5.00e-02	0.487912	-0.21756	-0.5736	0.934	6.35e-02
25	0.05688	-0.012570	1.57e-02	-0.108935	0.01088	0.1512	1.142	4.63e-03
26	-0.16136	-0.246137	1.03e-01	-0.032603	0.14620	0.3700	0.915	2.66e-02
27	-0.10215	-0.009644	1.23e-01	-0.060711	-0.02706	0.1484	1.143	4.46e-03
28	-0.07392	-0.044129	2.00e-01	-0.125498	-0.12811	-0.2390	1.221	1.16e-02
29	-0.02018	-0.000978	1.21e-02	-0.009819	0.01130	-0.0259	1.207	1.36e-04
30	0.00938	-0.009923	5.52e-03	0.011230	-0.02470	0.0392	1.140	3.13e-04
31	-0.02609	0.012102	1.78e-02	0.024634	-0.02304	0.0639	1.132	8.29e-04
32	-0.00838	0.088035	-7.74e-02	0.241951	-0.11084	-0.3208	1.060	2.05e-02
33	0.46713	0.076246	-3.30e-01	-0.085470	0.06538	0.5016	1.286	5.04e-02
34	-0.01793	-0.290469	1.24e-01	-0.069965	-0.02578	-0.3543	1.154	2.52e-02
35	0.19116	0.364587	-3.30e-02	0.000948	-0.29334	0.4762	1.213	

4.53e-02

36 -0.02479 -0.003745 2.16e-02 0.001305 -0.00579 0.0372 1.136 2.82e-04

37 -0.23303 0.195306 -7.32e-04 0.375407 -0.13705 -0.5834 1.041 6.66e-02

38 -0.00635 0.006666 -3.34e-03 -0.006348 0.01520 -0.0230 1.155 1.08e-04

39 -0.00635 0.003536 -2.26e-02 0.099351 -0.04673 -0.1366 1.104 3.77e-03

40 -0.04156 -0.109398 -1.30e-01 0.335766 0.03032 0.4370 0.818 3.63e-02

41 -0.02513 0.015047 2.98e-02 -0.027477 -0.00422 -0.0495 1.146 5.00e-04

42 0.02885 -0.021714 -2.78e-02 0.012535 0.00912 -0.0471 1.198 4.51e-04

43 -0.06015 -0.022175 1.94e-01 -0.106445 -0.14600 0.2611 1.039 1.36e-02

44 0.05715 -0.037151 -9.98e-03 0.044821 -0.08242 -0.1863 1.011 6.92e-03

45 0.01907 -0.001495 4.14e-02 0.103539 -0.18373 -0.2105 1.307 8.99e-03

46 -0.03604 0.040215 -5.00e-02 0.064098 0.05127 -0.1352 1.146 3.70e-03

47 -0.03284 -0.045425 6.51e-02 -0.014020 -0.04547 -0.1019 1.123 2.11e-03

48 -0.21378 0.115182 1.20e-01 -0.273961 0.23181 -0.4381 1.084 3.81e-02

49 -0.01066 0.025452 -1.43e-01 -0.112766 0.32750 -0.3950 0.956 3.05e-02

50 0.06216 0.020382 -3.27e-02 0.019786 -0.03988 0.0797 1.194
1.29e-03

51 0.00329 0.019009 -1.58e-01 0.032803 0.23398 0.2933 1.045
1.71e-02

52 0.05763 -0.118390 -3.56e-02 -0.007227 0.03996 -0.1587 1.282 5.12e-03

53 -0.05916 -0.066010 1.41e-01 -0.094379 -0.06784 -0.1970 1.092 7.81e-03

54 0.10763 -0.038090 1.69e-01 -0.102181 -0.29855 0.3819 1.279 2.94e-02

55 -0.05182 -0.020186 1.06e-01 -0.090208 -0.03803 -0.1613 1.073 5.24e-03

56 -0.07414 0.109356 1.12e-01 -0.182591 0.00952 -0.2482 1.082 1.23e-02

57 -0.00511 -0.051442 -8.18e-03 0.046188 -0.00239 -0.0669 1.378 9.13e-04

58 0.03350 -0.041119 -1.38e-02 0.016618 -0.01312 0.0676 1.182 9.32e-04

59 0.10581 0.041077 -1.41e-01 0.083860 0.03356 0.2077 1.012
8.59e-03

hat inf

1 0.1048

2 0.1151

3 0.0510

4 0.1175

5 0.1132

6 0.0489

7 0.0509

8 0.1159

9 0.0402

10 0.1677 *

11 0.0708

12 0.0457

13 0.0350

14 0.1086

15 0.0346

16	0.2133	*
17	0.0851	
18	0.0914	
19	0.0498	
20	0.0502	
21	0.0705	
22	0.0490	
23	0.0239	
24	0.1010	
25	0.0669	
26	0.0509	
27	0.0669	
28	0.1320	
29	0.0908	
30	0.0399	
31	0.0391	
32	0.0768	
33	0.2161	*
34	0.1243	
35	0.1786	
36	0.0366	
37	0.1363	
38	0.0500	
39	0.0431	
40	0.0482	
41	0.0461	
42	0.0853	
43	0.0541	
44	0.0283	
45	0.1764	*
46	0.0651	
47	0.0434	
48	0.1159	
49	0.0654	
50	0.0865	
51	0.0647	
52	0.1548	*
53	0.0552	
54	0.1902	*
55	0.0380	
56	0.0655	
57	0.2048	*
58	0.0759	
59	0.0336	