Sec.11-1 (p.599)

6. A medical researcher wishes to see if hospital patients in a large hospital have the same blood type distribution as those in the general population. The distribution for the general population is as follows: type A, 20%; type B, 28%; type O, 36%; and type AB = 16%. He selects a random sample of 50 patients and finds the following: 12 have type A blood, 8 have type B, 24 have type O, and 6 have type AB blood. At α = 0.10, can it be concluded that the distribution is the same as that of the general population?

medical researcher 醫學研究人員; hospital patients 住院患者; general population 普通人群;

Step 1. 假設

H_0: The distribution of the blood type of the patients were as follow:

20% were type A, 28% were type B, 36% were type O, and 16% were type AB (claim)

H_1: The distribution is not the same as stated in the null hypothesis

Step 2. 拒絕域

$$\alpha = 0.1, d.f. = k - 1 = 4 - 1 = 3$$
$$\chi^2_{(\alpha,df)} = \chi^2_{(0.1,3)} = 6.251$$
$$R = \{\chi^2 \geq 6.251\}$$

Step 3. 檢定統計量

$$E = n \cdot p, n = 50$$

Category	**A**	**B**	**O**	**AB**
Observed	12	8	24	6
Expected	$50 \cdot 0.2 = 10$	$50 \cdot 0.28 = 14$	$50 \cdot 0.36 = 18$	$50 \cdot 0.16 = 8$

$$\chi^2 = \sum \frac{(O - E)^2}{E} = 5.471$$

Step 4. 決策

$$5.471 \ngeq 6.251 \Rightarrow \text{不拒絕} H_0$$

Step 5. 結論

There is not enough evidence to reject the claim at α = 0.10.

給定顯著水準為 0.10 下，我們沒有足夠的證據拒絕宣稱

10. In a recent year, the most popular colors for light trucks were white, 31%; black, 19%; silver 11%; red 11%; gray 10%; blue 8%; and other 10%. A survey of randomly selected light truck owners in a particular area revealed the following. At α = 0.05, do the proportions differ from those stated?

White	**Black**	**Sliver**	**Red**	**Gray**	**Blue**	**Other**
45	32	30	30	22	15	6

light trucks 輕型卡車;

Step 1. 假設

H_0: The proportions of the most popular colors for light trucks is as follow:

31% were white, 19% were black, 11% were silver, 11% were red, 10% were gray, 8% were blue, and 10% were other

H_1: The proportions is not the same as stated in the null hypothesis (claim)

Step 2. 拒絕域

$$\alpha = 0.05, d.f. = k - 1 = 7 - 1 = 6$$
$$\chi^2_{(\alpha,df)} = \chi^2_{(0.05,6)} = 12.592$$
$$R = \{\chi^2 \geq 12.592\}$$

Step 3. 檢定統計量

$$E = n \cdot p, n = 180$$

Category	White	Black	Sliver	Red	Gray	Blue	Other
Observed	45	32	30	30	22	15	6
Expected	55.8	34.2	19.8	19.8	18	14.4	18

$$\chi^2 = \sum \frac{(O - E)^2}{E} = 21.655$$

Step 4. 決策

$$21.655 \geq 12.592 \Rightarrow \text{拒絕} H_0$$

Step 5. 結論

There is enough evidence to support the claim at α = 0.05.

給定顯著水準為 0.05 下，我們有足夠的證據支持宣稱

16. In a recent year U.S. retail automobile sales were categorized as listed below.

luxury 16.0% large 4.6% midsize 39.8% small 39.6%

A random sample of 150 recent purchases indicated the following results: 25 were luxury models, 12 were large cars, 60 were midsize, and 53 were small. At the 0.10 level of significance, is there sufficient evidence to conclude that the proportions of each type of car purchased differed from the report?

automobile 汽車;

Step 1. 假設

H_0: The proportions of each type of car purchased is as follow:

16.0% were luxury, 4.6% were large, 39.8% were midsize, and 39.6% were small

H_1: The proportions is not the same as stated in the null hypothesis (claim)

Step 2. 拒絕域

$$\alpha = 0.1, d.f. = k - 1 = 4 - 1 = 3$$
$$\chi^2_{(\alpha,df)} = \chi^2_{(0.1,3)} = 6.251$$
$$R = \{\chi^2 \geq 6.251\}$$

Step 3. 檢定統計量

$$E = n \cdot p, n = 50$$

Category	luxury	large	midsize	small
Observed	25	12	60	53
Expected	24	6.9	59.7	59.4

$$\chi^2 = \sum \frac{(O-E)^2}{E} = 4.502$$

Step 4. 決策

$$4.502 \ngeq 6.251 \Rightarrow \text{不拒絕} H_0$$

Step 5. 結論

There is not enough evidence to support the claim at α = 0.1.

給定顯著水準為 0.1 下，我們沒有足夠的證據支持宣稱

18. A researcher wishes to see if the number of randomly selected adults who do not have health insurance is equally distributed among three categories (less than 12 years of education, 12 years of education, more than 12 years of education). A sample of 60 adults who do not have health insurance is selected, and the results are shown. At α = 0.05, can it be concluded that the frequencies are not equal ? Use the P-value method. If the null hypothesis is rejected, give a possible reason for this.

Category	< 12 years	12 years	> 12 years
Frequency	29	20	11

insurance 保險;

Step 1. 假設

H_0: The number of randomly selected adults who do not have health insurance is equally distributed over the three education level

H_1: The number of randomly selected adults who do not have health insurance is not equally distributed over the three education level. (claim)

Step 2. 檢定統計量

equally distributed $\Rightarrow E = n/k, n = 60$

Category	**< 12 years**	**12 years**	**> 12 years**
Observed	29	20	11
Expected	20	20	20

$$\chi^2 = \sum \frac{(O-E)^2}{E} = 8.1$$

Step 3. p-value

$$d.f. = k - 1 = 3 - 1 = 2$$

	Significance level (α)							
Degrees of freedom (df)	.99	.975	.95	.9	.1	.05	.025	.01
1	-------	0.001	0.004	0.016	2.706	3.841	5.024	6.635
2	0.020	0.051	0.103	0.211	4.605	5.991	7.378	9.210

$$\Rightarrow 7.378 < 8.1 < 9.21$$

$$\Rightarrow 0.01 < p-value < 0.05$$

Step 4. 決策

$$p - value < 0.05 = \alpha \Rightarrow \text{拒絕} H_0$$

Step 5. 結論

There is enough evidence to support the claim at α = 0.05.

給定顯著水準為 0.05 下，我們有足夠的證據支持宣稱

Sec. 11-2 (p.613)

8. Are movie admissions related to ethnicity? A 2014 study indicated the following numbers of admissions (in thousands) for two different years. At the 0.05 level of significance, can it be concluded that movie attendance by year was dependent upon ethnicity?

	Caucasian	Hispanic	African American	Other
2013	724	335	174	107
2014	370	292	152	140

movie admissions 電影入場; ethnicity 種族

Step 1. 假設

H_0: The movie attendance by year was independent upon ethnicity.

H_1: The movie attendance by year was dependent upon ethnicity. (claim)

Step 2. 拒絕域

$$\alpha = 0.05$$
$$d.f. = (r-1)(c-1) = (2-1)(4-1) = 3$$

Degrees of freedom (df)	Significance level (α) .99	.975	.95	.9	.1	.05	.025	.01
1	-------	0.001	0.004	0.016	2.706	3.841	5.024	6.635
2	0.020	0.051	0.103	0.211	4.605	5.991	7.378	9.210
3	0.115	0.216	0.352	0.584	6.251	7.815	9.348	11.345

$$\chi^2_{(\alpha,df)} = \chi^2_{(0.05,3)} = 7.815$$
$$R = \{\chi^2 \geq 7.815\}$$

Step 3. 檢定統計量

Observed	Caucasian	Hispanic	African American	Other	Total
2013	724	335	174	107	1340
2014	370	292	152	140	954
Total	1094	627	326	247	2294

$$E = \frac{(row\ sum)(column\ sum)}{total}, E_{1,1} = \frac{1340 \cdot 1094}{2294} = 639.041, E_{1,2} = \frac{1340 \cdot 627}{2294} = 366.251, \text{etc.}$$

Expected	Caucasian	Hispanic	African American	Other
2013	639.041	366.251	190.427	144.281
2014	454.959	260.749	135.573	102.719

$$\chi^2 = \sum \frac{(O-E)^2}{E} = 60.143$$

Step 4. 決策

$$60.143 > 7.815 \Rightarrow \text{拒絕} H_0$$

Step 5. 結論

There is enough evidence to support the claim at α = 0.05.

給定顯著水準為 0.05 下，我們有足夠的證據支持宣稱

16. Listed is information regarding organ transplantation for three different years. Based on these data, is there sufficient evidence at α = 0.01 to conclude that a relationship exists between year and type of transplant?

Year	Heart	Kidney	Lung
2003	2056	870	1085
2004	2016	880	1173
2005	2127	903	1408

organ transplantation 器官移植;

Step 1. 假設

H_0: The type of transplant is independent of the year in which the transplant was received.

H_1: The type of transplant is dependent of the year in which the transplant was received. (claim)

Step 2. 拒絕域

$$\alpha = 0.01$$
$$d.f. = (r-1)(c-1) = (3-1)(3-1) = 4$$

Degrees of freedom (*df*)	Significance level (α) .99	.975	.95	.9	.1	.05	.025	.01
1	-------	0.001	0.004	0.016	2.706	3.841	5.024	6.635
2	0.020	0.051	0.103	0.211	4.605	5.991	7.378	9.210
3	0.115	0.216	0.352	0.584	6.251	7.815	9.348	11.345
4	0.297	0.484	0.711	1.064	7.779	9.488	11.143	13.277

$$\chi^2_{(\alpha,df)} = \chi^2_{(0.01,4)} = 13.277$$
$$R = \{\chi^2 \geq 13.277\}$$

Step 3. 檢定統計量

Observed	Heart	Kidney	Lung	Total
2003	2056	870	1085	4011
2004	2016	880	1173	4069
2005	2127	903	1408	4438
Total	6199	2653	3666	12518

$$E = \frac{(row\ sum)(column\ sum)}{total}$$

Expected	Heart	Kidney	Lung
2003	1986.275	850.071	1174.655
2004	2014.997	862.363	1191.640
2005	2197.728	940.567	1299.705

$$\chi^2 = \sum \frac{(O-E)^2}{E} = 23.21$$

Step 4. 決策

$$23.21 > 13.277 \Rightarrow \text{拒絕} H_0$$

Step 5. 結論

There is enough evidence to support the claim at α = 0.01.

給定顯著水準為 0.01 下，我們有足夠的證據支持宣稱

20. . To test the effectiveness of a new drug, a researcher gives one group of randomly selected individuals the new drug and another group of randomly selected individuals a placebo. The results of the study are shown here. At α = 0.10, can the researcher conclude that the drug results differ from those of the placebo? Use the P-value method.

Medication	Effective	Not effective
Drug	32	9
Placebo	12	18

Step 1. 假設

H_0: The drug results is independent of medication.

H_1: The drug results is dependent of medication. (claim)

Step 2. 檢定統計量

Observed	Effective	Not effective	Total
Drug	32	9	41
Placebo	12	18	30
Total	44	27	71

$$E = \frac{(row\ sum)(column\ sum)}{total}$$

Expected	Heart	Lung
2003	25.408	15.592
2005	18.592	11.408

$$\chi^2 = \sum \frac{(O-E)^2}{E} = 10.643$$

Step 3. p-value

$$d.f. = (r-1)(c-1) = (2-1)(2-1) = 1$$

Degrees of freedom (df)	Significance level (α) .99	.975	.95	.9	.1	.05	.025	.01
1	-------	0.001	0.004	0.016	2.706	3.841	5.024	6.635

$$\Rightarrow 6.635 < 10.643$$
$$\Rightarrow p - value < 0.01$$

Step 4. 決策

$$p - value < 0.1 = \alpha \Rightarrow \text{拒絕} H_0$$

Step 5. 結論

There is enough evidence to support the claim at α = 0.1.

給定顯著水準為 0.1 下，我們有足夠的證據支持宣稱

28. On average, 79% of American fathers are in the delivery room when their children are born. A physician's assistant surveyed 300 randomly selected first-time fathers to determine if they had been in the delivery room when their children were born. The results are shown here. At α = 0.05, is there enough evidence to reject the claim that the proportions of those who were in the delivery room at the time of birth are the same?

	Hospital A	Hospital B	Hospital C	Hospital D
Present	66	60	57	56
Not present	9	15	18	19
Total	75	75	75	75

delivery room 產房; physician's assistant 醫師助理;

Step 1. 假設

$H_0: p_1 = p_2 = p_3 = p_4$(claim)

H_1: At least one proportion is different

Step 2. 拒絕域

$$\alpha = 0.05$$
$$d.f. = (r-1)(c-1) = (2-1)(4-1) = 3$$

Degrees of freedom (df)	Significance level (α) .99	.975	.95	.9	.1	.05	.025	.01
1	-------	0.001	0.004	0.016	2.706	3.841	5.024	6.635
2	0.020	0.051	0.103	0.211	4.605	5.991	7.378	9.210
3	0.115	0.216	0.352	0.584	6.251	7.815	9.348	11.345

$$\chi^2_{(\alpha,df)} = \chi^2_{(0.05,3)} = 7.815$$
$$R = \{\chi^2 \geq 7.815\}$$

Step 3. 檢定統計量

Observed	Hospital A	Hospital B	Hospital C	Hospital D	Total
Present	66	60	57	56	239
Not present	9	15	18	19	61
Total	75	75	75	75	300

$$E = \frac{(row\ sum)(column\ sum)}{total}$$

Expected	Hospital A	Hospital B	Hospital C	Hospital D
2003	59.75	59.75	59.75	59.75
2005	15.250	15.250	15.250	15.250

$$\chi^2 = \sum \frac{(O-E)^2}{E} = 5$$

Step 4. 決策

$$5 \ngeq 7.815 \Rightarrow \text{不拒絕} H_0$$

Step 5. 結論

There is not enough evidence to reject the claim at α = 0.05.

給定顯著水準為 0.05 下，我們沒有足夠的證據拒絕宣稱

Sec. 11-3 (p.627)

8. The amount of sodium (in milligrams) in one serving for a random sample of three different kinds of foods is listed. At the 0.05 level of significance, is there sufficient evidence to conclude that a difference in mean sodium amounts exists among condiments, cereals, and desseets.

Condiments	Cereals	Desserts
270	260	100
130	220	180
230	290	250
180	290	250
80	200	300
70	320	360
200	140	300
		160

sodium 鈉; condiments 調味品; cereals 穀物;

Step 1. 假設

$H_0: \mu_1 = \mu_2 = \mu_3$

H_1: At least one mean is different. (claim)

Step 2. 拒絕域

$$\alpha = 0.05$$
$$d.f.N = k - 1 = 3 - 1 = 2$$
$$d.f.D = n - k = 22 - 3 = 19$$

	F-table of Critical Values of α = 0.05 for F(df1, df2)																		
	DF1=1	2	3	4	5	6	7	8	9	10	12	15	20	24	30	40	60	120	∞
DF2=1	161.45	199.50	215.71	224.58	230.16	233.99	236.77	238.88	240.54	241.88	243.91	245.95	248.01	249.05	250.10	251.14	252.20	253.25	254.31
19	4.38	3.52	3.13	2.90	2.74	2.63	2.54	2.48	2.42	2.38	2.31	2.23	2.16	2.11	2.07	2.03	1.98	1.93	1.88
20	4.35	3.49	3.10	2.87	2.71	2.60	2.51	2.45	2.39	2.35	2.28	2.20	2.12	2.08	2.04	1.99	1.95	1.90	1.84

$$R = \{F \geq 3.52\}$$

Step 3. 檢定統計量

1. 計算每組的樣本平均($\bar{X}_i$)和變異數(s_i^2)

	Condiments	Cereals	Desserts
Mean	165.714	245.714	237.5
Var	5695.238	3928.571	7335.714

2. 計算總平均

$$\bar{X}_{GM} = \frac{\sum X}{N} = 217.273$$

3. 計算組間變異

$$s_B^2 = \frac{\sum n_i(\bar{X}_i - \bar{X}_{GM})^2}{k-1} = 13771.799$$

4. 計算組內變異

$$s_W^2 = \frac{\sum(n_i - 1)s_i^2}{\sum(n_i - 1)} = 5741.729$$

5. 計算檢定統計量

$$F = \frac{s_B^2}{s_W^2} = 2.399$$

Step 4. 決策

$$2.399 \ngeq 3.52 \Rightarrow \text{不拒絕} H_0$$

Step 5. 結論

There is not enough evidence to support the claim at α = 0.05.

給定顯著水準為 0.05 下，我們沒有足夠的證據支持宣稱

11. The data shown are the weekly admissions (入場人數), in millions, of people attending movie theaters over three different time periods. At $\alpha = 0.05$, is there a difference in the means for the weekly attendance for these time periods?

1950-1974	1975-1990	1991-2000
58.0	17.1	23.3
39.0	19.9	26.6
25.1	19.6	27.7
19.8	20.3	26.5
17.7	22.9	25.8

admissions 入場人數;

Step 1. 假設

$H_0: \mu_1 = \mu_2 = \mu_3$

H_1: At least one mean is different. (claim)

Step 2. 拒絕域

$$\alpha = 0.05$$
$$d.f.N = k - 1 = 3 - 1 = 2$$
$$d.f.D = n - k = 15 - 3 = 12$$

F-table of Critical Values of α = 0.05 for F(df1, df2)

	DF1=1	2	3	4	5	6	7	8	9	10	12	15	20	24	30	40	60	120	∞
DF2=1	161.45	199.50	215.71	224.58	230.16	233.99	236.77	238.88	240.54	241.88	243.91	245.95	248.01	249.05	250.10	251.14	252.20	253.25	254.31
11	4.84	3.98	3.59	3.36	3.20	3.09	3.01	2.95	2.90	2.85	2.79	2.72	2.65	2.61	2.57	2.53	2.49	2.45	2.40
12	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.80	2.75	2.69	2.62	2.54	2.51	2.47	2.43	2.38	2.34	2.30

$$R = \{F \geq 3.89\}$$

Step 3. 檢定統計量

1. 計算每組的樣本平均($\bar{X}_i$)和變異數(s_i^2)

	1950-1974	1975-1990	1991-2000
Mean	31.92	19.96	25.98
Var	281.477	4.268	2.707

2. 計算總平均

$$\bar{X}_{GM} = \frac{\sum X}{N} = 25.953$$

3. 計算組間變異

$$s_B^2 = \frac{\sum n_i(\bar{X}_i - \bar{X}_{GM})^2}{k-1} = 178.805$$

4. 計算組內變異

$$s_W^2 = \frac{\sum (n_i - 1)s_i^2}{\sum (n_i - 1)} = 96.151$$

5. 計算檢定統計量

$$F=\frac{s_B^2}{s_W^2}=1.86$$

Step 4. 決策

$$1.86 \ngeq 3.89 \Rightarrow \text{不拒絕} H_0$$

Step 5. 結論

There is not enough evidence to support the claim at α = 0.05.

給定顯著水準為 0.05 下，我們沒有足夠的證據支持宣稱

16. Annual child care costs for infants are considerably higher than for older children. At α = 0.05, can you conclude a difference in mean infant day care costs for different regions of the United States? (Annual costs per infant are given in dollars.)

New England	Midwest	Southwest
10390	9449	7644
7592	6985	9691
8755	6677	5996
9464	5400	5386
7328	8372	

child care costs 托兒費用; infants 嬰幼兒;

Step 1. 假設

$H_0: \mu_1=\mu_2=\mu_3$

H_1: At least one mean is different. (claim)

Step 2. 拒絕域

$$\alpha=0.05$$
$$d.f.N=k-1=3-1=2$$
$$d.f.D=n-k=14-3=11$$

F-table of Critical Values of α = 0.05 for F(df1, df2)

	DF1=1	2	3	4	5	6	7	8	9	10	12	15	20	24	30	40	60	120	∞
DF2=1	161.45	199.50	215.71	224.58	230.16	233.99	236.77	238.88	240.54	241.88	243.91	245.95	248.01	249.05	250.10	251.14	252.20	253.25	254.31
11	4.84	3.98	3.59	3.36	3.20	3.09	3.01	2.95	2.90	2.85	2.79	2.72	2.65	2.61	2.57	2.53	2.49	2.45	2.40
12	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.80	2.75	2.69	2.62	2.54	2.51	2.47	2.43	2.38	2.34	2.30

$$R=\{F\geq 3.98\}$$

Step 3. 檢定統計量

1. 計算每組的樣本平均($\bar{X}_i$)和變異數(s_i^2)

	New England	Midwest	Southwest
Mean	8705.8	7376.6	7179.25
Var	1638175.2	2458850.3	3713568.917

2. 計算總平均

$$\bar{X}_{GM} = \frac{\sum X}{N} = 7794.929$$

3. 計算組間變異

$$s_B^2 = \frac{\sum n_i(\bar{X}_i - \bar{X}_{GM})^2}{k-1} = 3269834.089$$

4. 計算組內變異

$$s_W^2 = \frac{\sum (n_i - 1)s_i^2}{\sum (n_i - 1)} = 2502618.977$$

5. 計算檢定統計量

$$F = \frac{s_B^2}{s_W^2} = 1.307$$

Step 4. 決策

$$1.307 \ngeq 3.98 \Rightarrow \text{不拒絕} H_0$$

Step 5. 結論

There is not enough evidence to support the claim at α = 0.05.

給定顯著水準為 0.05 下，我們沒有足夠的證據支持宣稱

17. A research organization tested microwave ovens. At α = 0.10, is there a significant difference in the average prices of the three types of oven? A computer printout for this exercise is shown. Use the P-value method and the information in this printout to test the claim.

Watts		
1000	900	800
270	240	180
245	135	155
190	160	200
215	230	120
250	250	140
230	200	180
	200	140
	210	130

ANOVA SOURCE TABLE

Source	**df**	**SS**	**MS**	**F**	**p-value**
Between group	2	21729.735	10864.867	10.118	0.00102
Within group	19	20402.083	1073.794		
Total	21	42131.818			

DESCRIPTIVE STATISTICS

Condit	**N**	**Means**	**St Dev**
1000	6	233.333	28.23
900	8	203.125	39.36
800	8	155.625	28.21

Step 1.　假設

$H_0: \mu_1 = \mu_2 = \mu_3$

H_1: At least one mean is different. (claim)

Step 2.　檢定統計量

$$s_B^2 = 10864.867$$

$$s_W^2 = 1073.794$$

$$F = \frac{s_B^2}{s_W^2} = 10.118$$

Step 3.　p-value

$$p - value = 0.00102$$

Step 4.　決策

$$0.00102 < 0.1 = \alpha \Rightarrow \text{拒絕} H_0$$

Step 5.　結論

There is enough evidence to support the claim at α = 0.1.

給定顯著水準為 0.1 下，我們有足夠的證據支持宣稱

20. Kiplinger's listed the top 100 public colleges based on many factors. From that list, here is the average debt at graduation for various schools in four selected states. At α = 0.05, can it be concluded that the average debt at graduation differs for these four states?

New York	Virginia	California	Pennsylvania
14734	14254	13171	18105
16000	15176	14431	17051
14347	12665	14689	16103
14392	12591	13788	22400
12500	18385	15297	17976

Step 1.　假設

$H_0: \mu_1 = \mu_2 = \mu_3 = \mu_4$

H_1: At least one mean is different. (claim)

Step 2.　拒絕域

$$\alpha = 0.05$$

$$d.f.N = k - 1 = 4 - 1 = 3$$

$$d.f.D = n - k = 20 - 4 = 16$$

F-table of Critical Values of α = 0.05 for F(df1, df2)

	DF1=1	2	3	4	5	6	7	8	9	10	12	15	20	24	30	40	60	120	∞
DF2=1	161.45	199.50	215.71	224.58	230.16	233.99	236.77	238.88	240.54	241.88	243.91	245.95	248.01	249.05	250.10	251.14	252.20	253.25	254.31
15	4.54	3.68	3.29	3.06	2.90	2.79	2.71	2.64	2.59	2.54	2.48	2.40	2.33	2.29	2.25	2.20	2.16	2.11	2.07
16	4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.54	2.49	2.42	2.35	2.28	2.24	2.19	2.15	2.11	2.06	2.01

$$R = \{F \geq 3.24\}$$

Step 3. 檢定統計量

1. 計算每組的樣本平均($\bar{X}_i$)和變異數(s_i^2)

	New York	Virginia	California	Pennsylvania
Mean	14394.6	14614.2	14275.2	18327
Var	1571070.8	5639253.7	674050.2	5834041.5

2. 計算總平均

$$\bar{X}_{GM} = \frac{\sum X}{N} = 15402.75$$

3. 計算組間變異

$$s_B^2 = \frac{\sum n_i(\bar{X}_i - \bar{X}_{GM})^2}{k-1} = 19101307.65$$

4. 計算組內變異

$$s_W^2 = \frac{\sum(n_i - 1)s_i^2}{\sum(n_i - 1)} = 3429604.05$$

5. 計算檢定統計量

$$F = \frac{s_B^2}{s_W^2} = 5.57$$

Step 4. 決策

$$5.57 > 3.24 \Rightarrow \text{拒絕} H_0$$

Step 5. 結論

There is enough evidence to support the claim at α = 0.05.

給定顯著水準為 0.05 下，我們有足夠的證據支持宣稱