Module 6 Practice problem and Homework answers

Practice problem
page 3

	appearance x	appearance x^2	doctor x	doctor x^2	stigma x	stigma x^2
	15	225	18	324	35	1225
	37	1369	1	1	5	25
	14	196	24	576	3	9
	25	625	17	289	18	324
	5	25	13	169	22	484
	22	484	32	1024	27	729
	9	81	19	361	7	49
	31	961	6	36	33	1089
	20	400	1	1	0	0
	9	81	21	441	4	16
	37	1369	3	9	30	900
	1	1	26	676	1	1
	35	1225	14	196	23	529
$\sum x$	260		195		208	
$\sum x^2$		7042		4103		5380
$\overline{x}_k$	20		15		16	
$\overline{x}_o$	17					

What is the sum of scores for the appearance group?

    Answer: 260

    The first calculation row in the calculation table above gives the sum of scores for each group. In this row, we sum all of the x values for each group.

What is the sum of squared scores for the doctor's orders group?

    Answer: 4103

    The second calculation row in the calculation table above gives the sum of squared scores for each group. In this row, we sum all of the squared values for each group.

Practice problem page 3, continued

What is the group mean for the stigma group?

    Answer: 16

    The third calculation row in the calculation table gives the mean for each group, which was calculated using this formula:

$$\bar{x} = \frac{\sum x}{N} = \frac{208}{13} = 16$$

What is the overall mean?

    Answer: 17

    The fourth calculation row in the calculation table gives the overall mean. The easiest way to calculate the overall mean is to take the mean of the three group means.

$$\bar{x} = \frac{\sum x}{N} = \frac{51}{3} = 17$$

page 4

What are the Ns for each group?

    Answer: 13

    Each group has 13 cases.

What is the value of k in this problem?

    Answer: 3

    In ANOVA, k is the number of groups (which is always 3 or higher). The groups in this problem are appearance, doctor's orders, and stigma avoidance.

What is the value of ss_b?

    Answer: 182

$$ss_b = 13(20 - 17)^2 + 13(15 - 17)^2 + 13(16 - 17)^2$$

$$= 13(3)^2 + 13(-2)^2 + 13(-1)^2 = 13*9 + 13*4 + 13*1 = 182$$

Practice problem, page 5
What is the N of the entire dataset?

Answer: 39

There are 13 cases in each of the 3 groups (13*3=39).

What is the value of ss_t?

Answer: 5254

$7042+4103+5380-39*17^2 = 7042+4103+5380-39*289$
$$= 7042+4103+5380-11271$$
$$= 5254$$

page 6
What is the value of ss_w?

Answer: 5072

$Ss_w = ss_t - ss_b$
$$= 5254 - 182$$
$$= 5072$$

page 7
What is the value of df_w?

Answer: 36

df_w=N-k (N is total N, k is number of groups)
=39-3
=36

What is the value of df_b?

Answer: 2

df_b=k-1
=3-1
=2

page 8
What is the value of MS_w?

Answer: 140.89

$$MS_w = \frac{ss_w}{df_w} = \frac{5072}{36} = 140.89$$

Practice problem page 8, continued
What is the value of MS_b?

Answer: 91.00

$$MS_b = \frac{SS_b}{df_b} = \frac{182}{2} = 91.00$$

page 9
What is the value of F?

Answer: 0.646

$$F = \frac{MS_b}{MS_w} = \frac{91.00}{140.89} = 0.646$$

page 10
What is the critical F value for this problem?

Answer: 3.23

To use the F table, you find the dfb along the top (in this problem dfb=2), and the dfw along the side (in this problem, dfw=36). If the dfw for your problem is not given in the table, round up (in this case, we round up to 40).

Compare the calculated and critical F values and make a decision about the null hypothesis – can you reject it, or not?

Answer: Fail to reject the null hypothesis, and conclude that frequency of cheating is not significantly related to motivation for beginning a diet.

Because the calculated value (0.646) is lower than the critical value (3.23), we do not have evidence that the relationship between variables is significant. Therefore, we must fail to reject the null hypothesis.

Homework
page 1
Calculate the mean for mystery.

Answer: 8.3

$$\bar{x} = \frac{\Sigma x}{N} = \frac{83}{10} = 8.3$$

Calculate the mean for biography.

Answer: 7.5

$$\bar{x} = \frac{\Sigma x}{N} = \frac{75}{10} = 7.5$$

Homework page 1, continued

Calculate the mean for novels.

Answer: 13.2

$$\bar{x} = \frac{\sum x}{N} = \frac{132}{10} = 13.2$$

Calculate the mean for non-fiction.

Answer: 16.9

$$\bar{x} = \frac{\sum x}{N} = \frac{169}{10} = 16.9$$

Calculate the overall mean.

Answer: 11.5

$$\bar{x} = \frac{\sum x}{N} = \frac{45.9}{4} = 11.5$$

Calculate ss_b.

Answer: 583

$$ss_b = \sum N_k(\bar{x}_k - \bar{x}_o)^2 = 10(8.3\text{-}11.5)^2 + 10(7.5\text{-}11.5)^2 + 10(13.2\text{-}11.5)^2 + 10(16.9\text{-}11.5)^2$$
$$= 10(\text{-}3.2)^2 + 10(\text{-}4)^2 + 10(1.7)^2 + 10(5.4)^2$$
$$= 10*10.2 + 10*16 + 10*2.9 + 10*29.2$$
$$= 102 + 160 + 29 + 292$$
$$= 583$$

Calculate ss_w.

Answer: 1892

$$ss_T = \left(\sum x^2\right) - N\bar{x}_o{}^2 = \sum x_1^2 + \sum x_2^2 + \sum x_3^2 + \sum x_4^2 - N\bar{x}_o{}^2$$
$$= 1067 + 789 + 2610 + 3301 - 40(11.5)^2$$
$$= 1067 + 789 + 2610 + 3301 - 40*132.3$$
$$= 1067 + 789 + 2610 + 3301 - 5292$$
$$= 2475$$

$$ss_w = ss_t - ss_b = 2475\text{-}583 = 1892$$

Homework page 1, continued

Calculate F.

Answer: 3.69

$df_w = N - k, \ df_b = k - 1$
$df_w = 40 - 4, \ df_b = 4 - 1$
$df_w = 36, \ df_b = 3$

$$MS_w = \frac{SS_w}{df_w}, \ MS_b = \frac{SS_b}{df_b}$$

$$MS_w = \frac{1892}{36}, \ MS_b = \frac{583}{3}$$

$$MS_w = 52.6 \ MS_b = 194.3$$

$$F = \frac{MS_b}{MS_w}$$

$$F = \frac{194.3}{52.6}$$

$$F = 3.69$$

What is the critical value?

Answer: 2.84

The critical F value for $df_w = 36$ (we use 40) and $df_b = 3$ is 2.84.

Is the significance between book genres significant or not?

Answer: yes

Because the calculated value (3.69) is greater than the critical value (2.84), we can reject the null hypothesis, and conclude that there is a significant difference between groups.

page 2

Calculate the overall mean

Answer: 12.9

$$\bar{x} = \frac{\sum x}{N} = \frac{38.7}{3} = 12.9$$

Calculate the ss_b.

Answer: 58.5

$$ss_b = 5(15.7 - 12.9)^2 + 5(11.6 - 12.9)^2 + 5(11.4 - 12.9)^2$$

$$= 5(2.8)^2 + 5(-1.3)^2 + 5(-1.5)^2 = 5*7.8 + 5*1.7 + 5*2.2$$

$$= 39 + 8.5 + 11 = 58.5$$

Calculate the ss_w.

Answer: 522.1

$$ss_T = (\sum x^2) - N\bar{x}_o^2 = \Sigma x_1^2 + \Sigma x_2^2 + \Sigma x_3^2 - N\bar{x}_o^2$$

$$= 1460.16 + 871.9 + 744.5 - 15 * 12.9^2$$

$$= 1460.16 + 871.9 + 744.5 - 15 * 166.4$$

$$= 1460.16 + 871.9 + 744.5 - 2496$$

$$= 580.6$$

$$ss_w = ss_t - ss_b = 580.6\text{-}58.5 = 522.1$$

Calculate the F.

Answer: 0.67

$$df_w = N - k, \ df_b = k - 1$$
$$df_w = 15 - 3, \ df_b = 3 - 1$$
$$df_w = 12, \ df_b = 2$$

$$MS_w = \frac{SS_w}{df_w}, \ MS_b = \frac{SS_b}{df_b}$$

$$MS_w = \frac{522.1}{12}, \ MS_b = \frac{58.5}{2}$$

$$MS_w = 43.5 \ MS_b = 29.2$$

Homework page 2, continued

$$F = \frac{MS_b}{MS_w}$$

$$F = \frac{29.2}{43.5}$$

$$F = 0.67$$

What is the critical value?

Answer: 3.89

The critical F value for $df_w = 12$ and $df_b = 2$ is 3.89.

Is the significance between groups significant or not?

Answer: no

Because the calculated value (0.67) is not greater than the critical value (3.89), we cannot reject the null hypothesis, and must conclude that there is not a significant difference between groups.

page 3
Calculate the overall mean.

Answer:

$$\bar{x} = \frac{\sum x}{N} = \frac{59.6}{3} = 19.9$$

Calculate the ss_b.

Answer: 86.0

$$ss_b = 10(22.1 - 19.9)^2 + 10(18 - 19.9)^2 + 10(19.5 - 19.9)^2$$

$$= 10(2.2)^2 + 10(-1.9)^2 + 10(-0.4)^2 = 10*4.8 + 10*3.6 + 10*0.2$$

$$= 48 + 36 + 2 = 86$$

Homework page 3, continued

Calculate the ss_w.

Answer: 208

$$ss_T = \left(\sum x^2\right) - N\bar{x}_o{}^2 = \Sigma x_1^2 + \Sigma x_2^2 + \Sigma x_3^2 - N\bar{x}_o{}^2$$

$$= 4913 + 3402 + 3859 - 30 * 19.9^2$$

$$= 4913 + 3402 + 3859 - 30 * 396$$

$$= 4913 + 3402 + 3859 - 11880$$

$$= 294$$

$$ss_w = ss_t - ss_b = \text{294-86} = 208$$

Calculate the F.

Answer: 5.6

$$df_w = N - k, \; df_b = k - 1$$
$$df_w = 30 - 3, \; df_b = 3 - 1$$
$$df_w = 27, \; df_b = 2$$

$$MS_w = \frac{SS_w}{df_w}, \; MS_b = \frac{SS_b}{df_b}$$

$$MS_w = \frac{208}{27}, \; MS_b = \frac{86}{2}$$

$$MS_w = 7.7 \; MS_b = 43$$

$$F = \frac{MS_b}{MS_w}$$

$$F = \frac{43}{7.7}$$

$$F = 5.6$$

Homework page 3, continued

What is the critical value?

Answer: 3.35

The critical F value for $df_w = 27$ and $df_b = 2$ is 3.35.

Is the significance between groups significant or not?

Answer: yes

Because the calculated value (5.6) is greater than the critical value (3.35), we can reject the null hypothesis, and conclude that there is a significant difference between groups.