Experiments

Biscuit Experiment (height of biscuit)

- p.g. 331, exercise12
- RBD

12. **Biscuit experiment**
An experiment to study how to make fluffy biscuits was conducted by Nathan Buurma, Kermit Davis, Mark Gross, Mary Krejsa, and Khaled Zitoun in 1994. The two treatment factors of interest were "height of uncooked biscuit" (0.25, 0.50, or 0.75 inches, coded 1, 2, and 3) and "kneading time" (7, 14, or 21 times, coded 1, 2, and 3). The design used was a general complete block design. The $b = 4$ blocks consisted of the four runs of the oven, and the experimental units consisted of $k = 18$ positions on a baking pan. The $v = 9$ treatment combinations were each observed $s = 2$ times per block and $r = bs = 8$ times in total. The resulting observations are "percentage of original height" and are shown in Table 10.25.

Table 10.25 Data for the biscuit experiment (percentage of original height)

	Treatment Combination								
Block	11	12	13	21	22	23	31	32	33
1	350.0	375.0	362.5	237.5	237.5	256.3	191.7	216.7	208.3
	300.0	362.5	312.5	231.3	231.3	243.8	200.0	212.5	225.0
2	362.8	350.0	367.5	250.0	262.5	250.0	245.8	212.5	241.7
	412.5	350.0	387.5	268.8	231.3	237.5	225.0	250.0	225.0
3	350.0	387.5	425.0	300.0	275.0	231.3	204.4	187.5	187.5
	337.5	362.5	400.0	262.5	206.3	262.5	204.2	204.2	208.3
4	375.0	362.5	400.0	318.8	250.0	243.8	200.0	216.7	212.5
	350.0	337.5	350.0	256.3	243.8	250.0	150.0	183.3	187.5

Popcorn–Microwave Experiment

- An example on p.g. 205, every step of experiment is nicely laid out
- factorial

- might be a bit too complicated

Table 7.2 Percentage y_{ijkl} of kernels popped—popcorn–microwave experiment

Brand (i)	Power (j)	Time (k) 1	2	3
1	1	73.8, 65.5	70.3, 91.0	72.7, 81.9
1	2	70.8, 75.3	78.7, 88.7	74.1, 72.1
2	1	73.7, 65.8	93.4, 76.3	45.3, 47.6
2	2	79.3, 86.5	92.2, 84.7	66.3, 45.7
3	1	62.5, 65.0	50.1, 81.5	51.4, 67.7
3	2	82.1, 74.5	71.5, 80.0	64.0, 77.0
		$\overline{y}_{..1.} = 72.9000$	$\overline{y}_{..2.} = 79.8667$	$\overline{y}_{..3.} = 63.8167$

Table 7.3 Three-way ANOVA for the popcorn–microwave experiment

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	Ratio	p-value
B	2	331.1006	165.5503	1.89	0.1801
P	1	455.1111	455.1111	5.19	0.0351
T	2	1554.5756	777.2878	8.87	0.0021
B*P	2	196.0406	98.0203	1.12	0.3485
B*T	4	1433.8578	358.4644	4.09	0.0157
P*T	2	47.7089	23.8544	0.27	0.7648
B*P*T	4	47.3344	11.8336	0.13	0.9673
Treatments	17	4065.7289	239.1605	2.73	0.0206
Error	18	1577.8700	87.6594		
Total	35	5643.5989			

Soap

- p.g. 22
- Again, an example with each step nicely laid out
- RBD

Table 2.7 Weight loss for soaps in the soap experiment

Soap (Level)	Cube	Pre-weight (grams)	Post-weight (grams)	Weightloss (grams)
Regular (1)	1	13.14	13.44	−0.30
	2	13.17	13.27	−0.10
	3	13.17	13.31	−0.14
	4	13.17	12.77	0.40
Deodorant (2)	5	13.03	10.40	2.63
	6	13.18	10.57	2.61
	7	13.12	10.71	2.41
	8	13.19	10.04	3.15
Moisturizing (3)	9	13.14	11.28	1.86
	10	13.19	11.16	2.03
	11	13.06	10.80	2.26
	12	13.00	11.18	1.82

-

Algorithm

- Fairly simple, not in the book but found something similar here
- https://github.com/jabbalaci/SpeedTests?tab=readme-ov-file
- data not available but algorithm is easy to implement
- can also run experiments automatically