

Exercises 10

1. An electronic engineer is studying the variation in the resistance of a particular component for a mobile phone. Components are produced on one of the three available machines. Each machine has two outlets, left and right: each component is processed from precisely one of these outlets. Four components are randomly selected from each of the set of components processed by the outlets. The data for this 2-stage nested design are summarized below.

Machine	Outlet	Resistance (Ohms)			
1	left	4.0	5.5	5.5	9.0
	right	4.5	6.0	5.0	6.5
2	left	3.0	4.0	6.0	7.0
	right	5.0	4.0	7.5	7.5
3	left	3.5	5.0	6.0	7.5
	right	3.5	4.5	5.0	7.5

- Identify the factors in this design, and specify whether they are both fixed, both random, or one is fixed and the other random.
- Fit an appropriate model to the data, and carry out an analysis of it.
- Is the use of different machines and different outlets making a contribution to the variation in the resistances of the components? Justify your answer.

2. An advertising agency is interested in any differences in the amount of television watched by viewers in the South East and South West *regions*. Three *councils* were randomly selected from within each of these regions, and two *wards* were randomly selected from within each of the councils. Finally, two individuals were selected at random from each ward, and were interviewed to ascertain how many hours of television they watched per month. The data collected from this survey are given below.

	REGION											
	South East						South West					
COUNCILS	1		2		3		4		5		6	
WARDS	1	2	1	2	1	2	1	2	1	2	1	2
	20.0	13.5	47.5	34.5	32.5	39.0	11.0	11.5	41.5	37.5	30.5	17.5
	31.5	15.0	33.5	23.5	27.0	22.5	5.0	19.5	31.0	32.0	38.5	31.0

- For this *3-stage nested design*, state the factors by which the responses have been classified, and specify whether they should be considered fixed or random.
- State an appropriate linear statistical model for this experimental design, stating what each term in it represents with reference to the particular problem under consideration.
- Carry out an analysis of the data, and give an account of the effects and/or variances, if any, that are statistically significant.