

Assignment 3

Due Oct. 26

Only turn in Problem 1, not Problem 2.

1. Toxicity of insecticides: Flour beetles *Tribolium castaneum* were sprayed with one of the three insecticides in solution at different doses. The number of insects killed after a six-day period is recorded below:

Insecticide	Deposit of insecticide ($mg/10cm^2$)					
	2.00	2.64	3.48	4.59	6.06	8.00
DDT	3/50	5/49	19/47	19/38	24/49	35/50
γ -BHC	2/50	14/49	20/50	27/50	41/50	40/50
DDT + γ -BHC	28/50	37/50	46/50	48/50	48/50	50/50

- (a) Investigate graphically the relationship between dose, either in original units or in log units and the kill rate.
- (b) On the graph for part (a), plot the logistic fitted curve for each of the insecticides including the combination.
- (c) Consider two models, one in which the relationship is described by three parallel straight lines in the log dose and one in which the three lines are straight but not parallel. Assess the evidence against the hypothesis of parallelism.
- (d) Let chem be a 3-level factor, and let ldose be the log dose. Explain the relationship between the regression coefficients in the model formulae chem + ldose and chem + ldose -1. Explain the relationship between the two covariance matrices.
- (e) On the assumption that three parallel straight lines suffice, estimate the potency of the combination relative to each of the components. Use Delta method to obtain a 90% confidence interval for each of these relative potencies.
- (f) Use Fieller's method to obtain a 90% confidence interval for each of the above relative potencies.
- (g) Give your answer to the previous two parts under the c-log-log link.
- (h) Under the logistic model, estimate the combination dose required to give a 99% kill rate, and obtain a 90% confidence interval for this dose.
- (i) Give a brief summary of your conclusions regarding the effectiveness of these three insecticides.