(1) UC Berkley and Gender Discrimination in College Admissions In 1973, the University of California-Berkeley was sued for sex discrimination. The numbers looked pretty incriminating: the graduate schools had just accepted 44% of male applicants but only 35% of female applicants. Let's check it out!

Data below are from the 6 largest departments on campus at the time.

Department	Gender	Accept	Reject	% Accept
A	Men	512	313	62
	Women	89	19	82
В	Men	353	207	63
	Women	17	8	68
C	Men	120	205	37
	Women	202	391	34
D	Men	138	279	33
	Women	131	244	35
E	Men	53	138	28
	Women	94	299	24
F	Men	22	351	6
	Women	24	317	7
Total	Men	1198	1493	41
	Women	557	1278	30

- (a) Test the null hypothesis of homogeneity of the odds ratio of a woman being admitted to graduate school compared to a man being admitted to graduate school across different departments. Be sure to state your hypotheses and interpret your result in the context of the problem. Use  $\alpha = 0.01$ .
- (b) Assuming homogeneous association, calculate an estimate of the common odds ratio.
- (c) Test the null hypothesis that admission decision is independent of gender, conditional on the department. Interpret. Use  $\alpha = 0.01$ .
- (2) Suppose that we have two drug treatments, A and B (variable X), and we define a response variable, Y, in terms of success and failure of the treatment. The treatments are taking place at two clinics which we'll label by Z = 1, 2.

Clinic $(Z)$	Treatment (X)	Success	Failure
1	А	18	12
	В	12	8
2	А	2	8
	В	8	32
Overall	А	20	20
	В	20	40

- (a) Test the null hypothesis of homogeneity of the odds ratio of treatment A compared to treatment B across different clinics. Be sure to state your hypotheses and interpret your result in the context of the problem. Use  $\alpha = 0.05$ .
- (b) Calculate an estimate of the common odds ratio.
- (c) Test the null hypothesis that the outcome is independent of treatment, conditional on clinic. Interpret. Use  $\alpha = 0.05$ .
- (3) Let  $\pi(x)$  be given by the following logistic model:

$$\pi(x) = \frac{e^{\beta_0 + \beta_1 x}}{1 + e^{\beta_0 + \beta_1 x}}$$

Show that the natural log of the odds yields the logit, g(x).

(4) **Duct Tape.** Some people seem to believe that you can fix anything with duct tape. Even so, many were skeptical when researchers announced that duct tape may be a more effective and less painful alternative than liquid nitrogen, which doctors routinely use to freeze warts. Data consistent with values in the article "What a Fix-It: Duct Tape Can Remove Warts" (San Luis Obispo Tribune, October 15, 2002) are summarized in the following table:

Treatment	Wart Successfully Removed	Unsuccessful	Total
Liquid nitrogen freezing	60	40	100
Duct Tape	88	16	104

- (a) Calculate the odds ratio for a wart being successfully removed with duct tape (as compared to liquid nitrogen). Interpret your value in the context of the problem.
- (b) Construct a 95% interval estimate for the population odds ratio,  $\theta$ . Interpret your interval in the context of the problem.