HW # 8 Stat 13.1

8.4

(a) The explanatory variable is coffee consumption rate.
(b) The response variable is coronary heart disease (present or absent).
(c) The observational units are subjects (ie., the 1,040 persons).

8.9

People eating the potato chips made with Olestra might expect to have gastrointestinal problems. Thus, the expectation of problems might lead to those problems occurring (a nocebo effect). It is important that the subjects don't know which group they are in, so that any nocebo effect is seen evenly across the two groups. Likewise, the persons evaluating the3 subjects should be blinded, so that there is no bias in recording any symptoms that do arise.

8.20

Plan III is the best; with this randomized block design each treatment occurs twice on each tier so that any "tier effects" are balanced out between treatments. Plan I (a completely randomized design) is second best. Plan II is the worst; with this plan the effect of light is confounded with the effects of the three treatments, so that if T3 has the highest mean we won't know if this is due to T3 being the best of due to the third tier having more light than the other tiers.

8.29

The sample fraction of "yes" is 43/104 = .4135. This estimates the Pr(Yes). And since we know:

Pr(Yes) = .5 * p +.25

Then:

$$.4135 = .5 * \hat{p} + .25$$

$$\hat{p} = \frac{.4135 - .25}{.5} = .327$$

9.3
1)

Standard Error:

$$SE_{(\bar{y}_1 - \bar{y}_2)} = SE_{\bar{d}} = \frac{SD_d}{\sqrt{n_d}} = \frac{.40}{\sqrt{4}} = .20$$

2)

95% CI for the mean difference

$$\bar{d} \pm t(df)_{\alpha/2} \cdot SE_{\bar{d}}$$
$$.68 \pm 3.182 \cdot .20$$
$$(.0436, 1.3164)$$

3)

Let 1 denote the control and 2 denote the progesterone:
H_0: Progesterone has no effect on cAMP ($\mu_1 = \mu_2$)
H_A: Progesterone has some effect on cAMP ($\mu_1 \neq \mu_2$)

Test Statistic:

$$t_s = \frac{\bar{y}_1 - \bar{y}2}{SE_{(\bar{y}_1 - \bar{y}_2)}} = \frac{\bar{d}}{SE_{\bar{d}}} = \frac{.68}{.20} = 3.4$$

Degrees of Freedom:

df = n - 1 = 4 - 1 = 3

Now we go to table 4 looking at values under 3 degrees of freedom:

$$t_{.025} = 3.182$$
$$t_{.02} = 3.284$$

So we know that:

$$.04 < p - val < .05 = \alpha$$

Sinse our alpha value is higher than our p-value, at an alpha level of .1, we reject H_0. Therefore, we conclude that there is sufficient evidence that progesterone changes cAMP under these conditions.

9.19

Let p denote the probability that a patient will have fewer minor seizures with valproate than with placebo.

H_0: Valporate is not effective against minor seizures (p=.5)
H_A: Valporate is effective against minor seizures (p > .5)

Note, answers are given for two tests. Either is acceptable.

Sign Rank Test

$N_+ = 14$

$N_- = 5$

$B_s = 14$

We see that the data does deviate from the null hypothesis in the direction of the alternative hypothesis. We eliminate the pair with d=0 and then look at table 7 with n_d=19. Here we can see that for a one sided alternative, at 14, our p-val < .05, Therefore we reject H_0.Therefore, there is sufficient evidence to conclude that the Valporate is effective against minor seizures.

Rank Sum Test

Patient Number	Placebo Period	Valproate Period	Difference	Signed Rank
1	37	5	32	19
2	52	22	30	17
3	63	41	22	13
4	2	4	-2	-4
5	25	32	-7	-9
6	29	20	9	10
7	15	10	5	7
8	52	25	27	16
9	19	17	2	4
10	12	14	-2	-4
11	7	8	-1	-2
12	9	8	1	2
13	65	30	35	20
14	52	22	30	17
15	6	11	-5	-7
16	17	1	16	12
17	54	31	23	14
18	27	15	12	11
19	36	13	23	14
20	5	5	0	0

$W_+ = 176$
$W_- = 26$
$W_S = 176$
We see that the data does deviate from the null hypothesis in the direction of the alternative hypothesis.

We eliminate the pair with d=0 and then we look at table 8 with n=19. From this we can see that:

$p - val < .005$

Therefore we reject H_0

Therefore, there is sufficient evidence to conclude that the Valporate is effective against minor seizures.

9.33

H_0: Alcoholism has no effect on brain density
H_A: Alcoholism reduces brain density

The differences tend to be negative, which is consistent with H_A.

Note, answers are given for two tests. Either is acceptable.

Sign Rank Test

$N_+ = 9$
$N_- = 2$
$B_s = 9$

Now we look at table 7 with n=11 and see that:

$p - val \approx .01611 < .02$

Therefore we reject H_0
Therefore there is evidence to conclude that alcoholism is associated with reduced brain density.

Rank Sum Test

Now we calculate the ranks of the absolute value of the differences with their signs:

Pair	Alcoholic	Control	Difference	Abs (Diff)	Signed Ranks
1	40.1	41.3	-1.2	**1.2**	**-5**
2	38.5	40.2	-1.7	**1.7**	**-7**
3	36.9	37.4	-0.5	**0.5**	**-4**
4	41.4	46.1	-4.7	**4.7**	**-11**
5	40.6	43.9	-3.3	**3.3**	**-10**
6	42.3	41.9	0.4	**0.4**	**3**
7	37.2	39.9	-2.7	**2.7**	**-9**
8	38.6	40.4	-1.8	**1.8**	**-8**
9	38.5	38.6	-0.1	**0.1**	**-1**
10	38.4	38.1	0.3	**0.3**	**2**
11	38.1	39.5	-1.4	**1.4**	**-6**

From this we calculate:

$$W_+ = 3 + 2 = 5$$
$$W_- = 5 + 7 + 4 + 11 + 10 + 9 + 8 + 1 + 6 = 61$$
$$W_s = 61$$

Now we look at table 8 with n=11. From this we can see that:

$$.001 < p - val < .005$$

Therefore we reject H_0
Therefore there is evidence to conclude that alcoholism is associated with reduced brain density.