Part 1

Problem 1

Without using a formal statistical model, provide an estimate of the common odds ratio and its 95% confidence interval for the effect of pooled treatment (high dose + low dose) vs. placebo on the severity of the adverse event, dichotomized as (none or mild) vs. (moderate or severe), when controlling for sex.

The Common odds ratio is 2.146 with a 95% CI $(1.370, 3.361)$
Subjects with in the pooled treatment group have 2.146 times the odds of having a moderate or severe adverse event (vs none or mild) compared to the odds of a subject in the placebo group, when controlling for sex.

Problem 2

Without using a formal statistical model, statistically test the null hypothesis that the effect of pooled treatment high dose and low dose vs. placebo on the dichotomized severity of the adverse event none or mild vs. moderate or severe is the same for each sex. Provide a sentence explaining your results.

Conducting a breslow day test for homogeneity of the odds ratios to test the null hypothesis that the effect of pooled treatment high dose and low dose vs. placebo on the dichotomized severity of the adverse event none or mild vs. moderate or severe is the same for each sex.
H_0: The Odds ratio for each gender are homogeneous

Breslow-Day Test for Homogeneity of Odds Ratios	
Chi-Square	1.1758
DF	1
Pr > ChiSq	0.2782

$\chi^2 = 1.176$ p-value=.278 $> .05$ Fail to reject H_0
Conclusion: There is not enough evidence to suggest the odds ratios for each sex are not homeogenous. Not enough evidence to suggest a statistically significant difference between the two sexes in the effect of pooled treatment vs placebo on the dichotomized severity of the adverse event none or mild vs. moderate or severe.

Problem 3

Under minimal assumptions, conduct a statistical test to determine whether there is a difference in the proportion of moderate or severe adverse event (vs. none or mild) among the three treatment groups, controlling for sex. For this problem, you should consider the treatment groups as nominal. Write a sentence to interpret your findings.

Conducting a Mantel-Haenszel Test
H_0: There is no difference in the proportions of moderate or severe adverse event (vs. none or mild) among the three treatment groups, controlling for sex.
$\chi^2_{MH} = 11.334$ $df = 2$ 2 p-value=.004 $< .05$ Reject H_0
Conclude that there is a significant difference in the proportion of moderate or severe adverse event among treatment groups, controlling for sex.

Problem 4

Under minimal assumptions, conduct a statistical test to determine whether there is a trend in the proportion of moderate or severe adverse event (vs. none or mild) across the ordered treatment groups, controlling for sex. Write a sentence to interpret your findings.

Conducting a Mantel-Haenszel Extension Test
H_0: There is no trend in the proportion of moderate or severe adverse event across the ordered treatment groups, controlling for sex.

Cochran-Mantel-Haenszel Statistics (Based on Table Scores)				
Statistic	Alternative Hypothesis	DF	Value	Prob
1	Nonzero Correlation	1	8.9471	0.0028

$Q_{CSMH} \sim \chi^2_1 = 8.947$ p-value=.003 $< .05$ Reject H_0
Conclude there is a statistically significant trend in the proportion of moderate or severe adverse event across the ordered treatment groups, controlling for sex.

Problem 5

Under minimal assumptions, conduct a statistical test to assess the association of pooled treatment (high dose + low dose) vs. placebo with the severity of adverse event (all four ordered levels managed as distinct), controlling for sex. Justify your method. If you determine that $p < 0.05$, discuss whether pooled treatment is associated with greater severity or lesser severity of the adverse event.

Mantel-Hanszel mean score test
Since we cannot assume that the levels of severity of adverse event are equally spaced, we will use modified ridit scores.
H_0: There is no association of pooled treatment with the ordered severity of adverse event

Cochran-Mantel-Haenszel Statistics (Modified Ridit Scores)				
Statistic	Alternative Hypothesis	DF	Value	Prob
1	Nonzero Correlation	1	19.3044	<.0001
2	Row Mean Scores Differ	1	19.3053	<.0001
3	General Association	3	20.9953	0.0001

$Q_{SMH} \sim \chi^2_1 = 19.305$ p-value$<$ .0001 Reject H_0
Conclude pooled treatment is associated the ordered severity of adverse event, controlling for sex.

Frequency Col Pct	Table 1 of dose by event Controlling for sex=m				
	event				
dose	none	mild	mod	sev	Total
0	16 50.00	16 37.21	12 24.00	8 17.39	52
1	16 50.00	27 62.79	38 76.00	38 82.61	119
Total	32	43	50	46	171

Frequency Col Pct	Table 2 of dose by event Controlling for sex=w				
	event				
dose	none	mild	mod	sev	Total
0	20 54.05	16 33.33	20 41.67	10 19.23	66
1	17 45.95	32 66.67	28 58.33	42 80.77	119
Total	37	48	48	52	185

Looking at the pooled treatment column percentages for each sex, they increase as the level of severity of adverse event increases. Pooled treatment appears to be associated with greater severity of adverse event, while controlling for sex.

Problem 6

Under minimal assumptions, conduct a statistical test to determine whether there is a progressive location shift in the severity of the adverse event (as distinct levels) across high dose, low dose, and placebo, controlling for sex. In a sentence, interpret your findings.

Cochran-Mantel-Haenszel test (Non-Zero Correlation Test)
H_0: There is no progressive shift in the distribution of the severity severity across treatment levels controlling for sex.
H_1 : There is a progressive shift in distribution.
$Q_{CSMH} \sim \chi^2_1 = 17.04$ p-value$<$ .0001 Reject H_0
Conclude there is a progressive shift in the distribution of the severity severity across treatment levels controlling for sex.

Problem 7

Report the Spearman rank correlation coefficients and corresponding 95% confidence intervals separately by sex as measures of association for pooled treatment (high dose + low dose) versus placebo with the severity of adverse event (as distinct levels). Write a sentence indicating whether men or women exhibit a stronger association, and briefly justify your finding.

Sex	Spearman Rank Correlation	95% CI
Male	.253	$(.11, .397)$
Female	.216	$(.079, .354)$

From the table, men in the pooled treatment group have a higher spearman rank correlation than women in the pooled treatment group, this suggests that they have a stronger association than women with severity of adverse event.

Problem 8

Report the Spearman rank correlation coefficients and corresponding 95% confidence intervals separately by sex as measures of association for ordered treatment groups with severity of the adverse event (as distinct levels). Write a sentence indicating whether men or women exhibit a stronger association, and briefly justify your finding.

Sex	Spearman Rank Correlation	95% CI
Male	.222	(.07, .373)
Female	.218	(.083, .352)

The results suggest that the associated between increased treatment level and increase severity of event is slightly stronger for men than for women.

Problem 9

Separately within each treatment group, test the association between sex and severity of the adverse event (as ordered distinct levels). Also, assess such association under minimal assumptions, and controlling for treatment groups. Write a sentence to interpret your results.

Conducting a χ^2 for trend for each treatment group
H_0: No association between sex and severity of the adverse event
Placebo Group:
$Q_S \sim \chi^2_1 = .135$ p-value=.713 $> .05$ Fail to reject H_0
Low dose group:
$Q_S \sim \chi^2_1 = .281$ p-value=.596 $> .05$ Fail to reject H_0
High dose group:
$Q_S \sim \chi^2_1 = .057$ p-value=.811 $> .05$ Fail to reject H_0
Conclusion: For each treatment group separately we fail to reject the null hypothesis that there is no association between sex and severity of adverse event. This suggests that there is not a statistically significant association between sex and severity of adverse event.

Problem 10

Analysis of Maximum Likelihood Estimates						
Parameter		DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept		1	-0.2813	0.2222	1.6019	0.2056
treat	h	1	0.7931	0.2689	8.6999	0.0032
treat	l	1	0.7428	0.2618	8.0487	0.0046
sex	w	1	-0.0470	0.2173	0.0467	0.8289

Assumptions: Assume data arose from stratified simple random sample so that response is distributed binomially for each for each treatment x sex combination
Each observation is independent from the others
The explanatory variables are linearly related to the log odds
There is little or no multicollinearity among the explanatory variables
Explanatory Variables
high indicator of high dose treatment
low indicator of low dose treatment
(placebo is 0 for both dose indicators)
sex indicator of female sex
(male is the reference)
Response indicator of moderate or severe adverse event
θ_{hi} is the probability that person with hth dose from ith sex has moderate or severe adverse event
$logit(\theta_{hi}) = \alpha + \beta_1 I(low) + \beta_2 I(high) + \beta_3 I(female)$
α is the intercept, the effect for the reference cell (placebo treatment,female sex)
β_1 is incremental effect for low dose
β_2 is incremental effect for high dose
β_3 is incremental effect for female sex
$logit(\theta_{hi}) = -.281 + .743 I(low) + .793 I(high) + -.047 I(female)$

Deviance and Pearson Goodness-of-Fit Statistics				
Criterion	Value	DF	Value/DF	Pr > ChiSq
Deviance	2.1986	2	1.0993	0.3331
Pearson	2.1942	2	1.0971	0.3338

H_0 : The model is an adequate fit
$Q_L = 2.199$ p-value=.333 $Q_P = 2.194$ p-value=.334
both Q_L and $Q_P \sim \chi^2_2$
Since both p-values> .05 Fail to reject H_0, The goodness of fits statistics support the adequacy of the model

Problem 11

Using the model from Problem 10, provide estimates and corresponding 95% confidence intervals for the odds ratios of high dose vs. placebo and of low dose vs. placebo for (moderate or severe) adverse event compared to (none or mild).

Odds ratio of high dose vs. placebo for (moderate or severe) adverse event.
$OR = 2.21$ 95% CI: $(1.305, 3.744)$
Odds ratio of low dose vs. placebo for (moderate or severe) adverse event.
$OR = 2.102$ 95% CI: $(1.258, 3.511)$

Problem 12

Using the model from Problem 10, perform a statistical test of whether the treatment groups differ with respect to the (moderate or severe) adverse event (i.e., the overall treatment effect). Provide the test statistic, indicate the number of degrees of freedom, and determine statistical significance through its p-value. If this overall effect is statistically significant, test each pairwise treatment comparison at the $\alpha = 0.05$ level, and indicate which treatment groups are significantly better than others. (Note: you do not need to address any adjustment to the type I error for multiple comparisons for this problem.)

Type 3 Analysis of Effects			
Effect	DF	Wald Chi-Square	Pr > ChiSq
treat	2	11.2138	0.0037
sex	1	0.0467	0.8289

Running a type 3 wald χ^2 test on the overall treatment effect
H_0 : The effect of treatment is not significant
$\chi^2 = 11.214$ df=2 p-value=.004 $< .05$ Reject H_0
conclude there the overall effect of treatment on moderate or severe adverse is event is statistically significant.
Wald χ^2 test testing pairwise treatment comparisons

Contrast Test Results			
Contrast	DF	Wald Chi-Square	Pr > ChiSq
high vs low	1	0.0356	0.8503

High dose vs placebo wald $\chi^2 = 8.7$ df=1 p-value=.003 $< .05$
Low dose vs placebo wald $\chi^2 = 8.049$ df=1 p-value=.005 $< .05$
High dose vs low dose wald $\chi^2 = .036$ df=1 p-value=.85 $> .05$
The results suggest both high dose and low dose are more effective than placebo
The difference in treatment effect between high and low dose is not statistically significant.

Problem 13

Using your model from Problem 10, what are the respective model-predicted probabilities for (moderate or severe) adverse event and for (none or mild) adverse event for men on high dose and also for women on placebo?

men on high dose $P(\text{moderate of severe}) = .602$
$P(\text{none or mild}) = 1 - .602 = .398$
women on placebo $P(\text{moderate of severe}) = .419$
$P(\text{none or mild}) = 1 - .419 = .581$

Problem 14

Assumptions: Data that arise from a stratified simple random sample, at least 5 observations at each outcome at each level of each main effect, $\beta_k = \beta$ for all k

Analysis of Maximum Likelihood Estimates						
Parameter		DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept	sev	1	-1.6186	0.2206	53.8095	<.0001
Intercept	mod	1	-0.4031	0.2046	3.8815	0.0488
Intercept	mild	1	0.8651	0.2104	16.9040	<.0001
treat	h	1	0.9978	0.2415	17.0757	<.0001
treat	l	1	0.8273	0.2343	12.4697	0.0004
sex	w	1	0.0118	0.1915	0.0038	0.9508

$logit(\theta_k) = \alpha_1 + \alpha_2 + \alpha_3 + x_1\beta_1 + x_2\beta_2 + x_3\beta_3$
where θ_1 is P(event=severe)
θ_2 is P(event=severe or event =moderate)
θ_3 is P(event=severe or event =moderate or event=mild)
α_1 Intercept for the 1st cumulative logit (log odds of severe event vs moderate, mild or none for males on placebo)
α_2 Intercept for the 2st cumulative logit (log odds of severe event or moderate vs mild or none for males on placebo)
α_3 Intercept for the 2st cumulative logit (log odds of severe event or moderate or mild vs none for males on placebo)
$x_1 = I$(treatment=high)
$x_2 = I$(treatment=low)
$x_3 = I$(sex=female)
β_1 Incremental effect for all 3 types of log odds due high dose treatment
β_2 Incremental effect for all 3 types of log odds due low dose treatment
β_3 Incremental effect for all 3 types of log odds due to female sex
Score Test for Proportional Odds Assumption
$H_0 : \beta_k = \beta$ for all k
$\chi^2 = 3.408$ df=6 p-value=.756 $> .05$ Fail to reject H_0
Conclude the overall proportional odds assumption holds

Score Test for the Proportional Odds Assumption		
Chi-Square	DF	Pr > ChiSq
3.4078	6	0.7562

Deviance and Pearson Goodness-of-Fit Statistics				
Criterion	Value	DF	Value/DF	Pr > ChiSq
Deviance	11.7852	12	0.9821	0.4631
Pearson	11.7115	12	0.9760	0.4691

H_0 : The model is an adequate fit
$Q_L = 11.785$ p-value=.463 $Q_P = 11.712$ p-value=.469
both Q_L and $Q_P \sim \chi^2_{12}$
Since both p-values$> .05$ Fail to reject H_0, The goodness of fits statistics support the adequacy of the model

Problem 15

Using the model from Problem 14 that assumes proportional odds, provide estimates and corresponding 95% confidence intervals for the odds ratios of high dose vs. placebo and of low dose vs. placebo for (severe or moderate) adverse event compared to (none or mild).

Odds Ratio Estimates				
Effect	event	Point Estimate	95% Wald Confidence Limits	
treat h vs p	sev	3.288	1.750	6.176
treat h vs p	mod	2.214	1.307	3.750
treat h vs p	mild	2.869	1.468	5.606
treat l vs p	sev	2.431	1.292	4.574
treat l vs p	mod	2.113	1.263	3.533
treat l vs p	mild	2.612	1.384	4.931
sex w vs m		1.012	0.694	1.476

The odds ratio of high dose vs. placebo for (severe or moderate) adverse event compared to (none or mild) is 2.214 with a 95% CI $(1.307, 3.750)$
The odds ratio of low dose vs. placebo for (severe or moderate) adverse event compared to (none or mild) is 2.113 with a 95% CI $(1.263, 3.533)$

Problem 16

Using the model from Problem 14 that assumes proportional odds, what are the respective model- predicted probabilities for none, mild, moderate, and severe adverse event for men on low dose?

Model Predicted probabilities for men on low dose	
Severity	Probability
None	.696
Mild	.845
Moderate	.607
Severe	.312

Problem 17

Assumptions:
Data is from a stratified random sample
Treatment is nominal
Cell counts are greater than 5
observations in the data set are independent
model fits the data adequately
$logit(\theta_{hij}) = \alpha_j + \boldsymbol{x}'_{hi}\boldsymbol{\beta}_j$
h=1,2,3 for placebo, low, high dose respectively (placebo is the reference)
i=1,2 for male and female sex respectively (male is the reference)
θ_{hij} is the odds of event severity with h treatment level and i sex
j=1,2,3 where j=1 is the odds of mild vs. none, j=2 is the odds of moderate vs. none, j=3 is the odds of severe vs. none
$x_{1i1} = I(\text{treat=h,j=1})$ $x_{1i2} = I(\text{treat=h,j=2})$ $x_{1i3} = I(\text{treat=h,j=3})$
$x_{2i1} = I(\text{treat=l,j=1})$ $x_{2i2} = I(\text{treat=l,j=2})$ $x_{2i3} = I(\text{treat=l,j=3})$
$x_{h11} = I(\text{sex=f,j=1})$ $x_{h12} = I(\text{sex=f,j=2})$ $x_{h13} = I(\text{sex=f,j=3})$
$\alpha_1 = -.121$ intercept for 1st cumulative logit (reference placebo, male sex)
$\alpha_2 = -.044$ intercept for 2nd cumulative logit (reference placebo, male sex)
$\alpha_3 = -.724$ intercept for 3rd cumulative logit (reference placebo, male sex)
$\beta_1 = .742$ incremental effect for high dose treatment for $logit_{hi1}$
$\beta_2 = .736$ incremental effect for high dose treatment for $logit_{hi2}$
$\beta_3 = 1.725$ incremental effect for high dose treatment for $logit_{hi3}$
$\beta_4 = .662$ incremental effect for low dose treatment for $logit_{hi1}$
$\beta_5 = .854$ incremental effect for low dose treatment for $logit_{hi2}$
$\beta_6 = 1.445$ incremental effect for low dose treatment for $logit_{hi3}$
$\beta_7 = .005$ incremental effect for female sex for $logit_{hi1}$
$\beta_8 = -.135$ incremental effect for female sex for $logit_{hi2}$
$\beta_9 = .053$ incremental effect for female sex for $logit_{hi3}$

Analysis of Maximum Likelihood Estimates

Parameter		event	DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept		mild	1	-0.1208	0.3042	0.1577	0.6913
Intercept		mod	1	-0.0438	0.2997	0.0214	0.8837
Intercept		sev	1	-0.7235	0.3437	4.4302	0.0353
treat	h	mild	1	0.7422	0.4020	3.4087	0.0649
treat	h	mod	1	0.7364	0.4020	3.3552	0.0670
treat	h	sev	1	1.7249	0.4172	17.0978	<.0001
treat	l	mild	1	0.6618	0.3841	2.9693	0.0849
treat	l	mod	1	0.8542	0.3763	5.1538	0.0232
treat	l	sev	1	1.4446	0.4073	12.5767	0.0004
sex	w	mild	1	0.00533	0.3231	0.0003	0.9868
sex	w	mod	1	-0.1346	0.3187	0.1783	0.6728
sex	w	sev	1	0.0530	0.3257	0.0265	0.8707

Problem 18

Using your model from Problem 17, provide estimates and corresponding 95% confidence intervals for the odds ratios of high dose vs. placebo and of low dose vs. placebo for each severity level compared to 'none'. Compare and contrast these results to those found in Problem 15.

Table of Odds ratio estimates and 95% CI

Odds Ratio Estimates				
Effect	event	Point Estimate	95% Wald Confidence Limits	
treat h vs p	mild	2.100	0.955	4.618
treat h vs p	mod	2.088	0.950	4.592
treat h vs p	sev	5.612	2.478	12.712
treat l vs p	mild	1.938	0.913	4.115
treat l vs p	mod	2.349	1.124	4.912
treat l vs p	sev	4.240	1.908	9.421
sex w vs m	mild	1.005	0.534	1.894
sex w vs m	mod	0.874	0.468	1.632
sex w vs m	sev	1.054	0.557	1.996

*compared to none event severity

The odds ratios are similar to the odds ratios in problem 15.

Part 2

Problem 19

Under minimal assumptions and controlling for baseline falls count in the prior eight weeks trichotomized as < 5 falls, 5-10 falls, or > 10 falls, conduct a statistical test to assess the association between treatment group and improvement, where improvement is defined as having fewer falls across the entire eight-week study period than during the preceding eight weeks, and no improvement is defined as having the same number or more falls. Briefly interpret your results in 1-2 sentences.

Mantel-Haenszel Test
H_0 : There is no association between treatment group and improvement when controlling for baseline falls. $\chi^2_1 = 83.234$ p-value$< .0001$ Reject H_0
Conclude there is evidence of a statistically significant association between treatment group and improvement when controlling for baseline falls.

Problem 20

Fitting a poisson regression model
$\log(\mu(x)) = x'\beta =$
$\beta_0 + \beta_1 I(activetreatment) + \beta_2 I(tribase1) + \beta_3 I(tribase2) + \beta_4 age$
where tribase=1 is $5 < baselinefalls < 10$ tribase=2 is > 10
Table of GOF Statistics

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	54	116.5273	2.1579
Scaled Deviance	54	116.5273	2.1579
Pearson Chi-Square	54	123.5430	2.2878
Scaled Pearson X2	54	123.5430	2.2878
Log Likelihood		444.1956	
Full Log Likelihood		-153.3646	
AIC (smaller is better)		316.7292	
AICC (smaller is better)		317.8613	
BIC (smaller is better)		327.1169	

With values of 2.158 for the deviance/df and 2.288 for Pearson/df, there is evidence of overdispersion.
Adjusting for over-dispersion using a scale parameter
Table of parameter estimates, standard errors, test statistics and p-values

Analysis Of Maximum Likelihood Parameter Estimates								
Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept		1	-0.9326	3.4211	-7.6378	5.7726	0.07	0.7852
treatment	1	1	-0.7427	0.1629	-1.0620	-0.4233	20.77	<.0001
tribase	1	1	0.3559	0.2783	-0.1895	0.9013	1.64	0.2009
tribase	2	1	1.5305	0.2132	1.1127	1.9483	51.55	<.0001
age		1	0.0288	0.0436	-0.0566	0.1142	0.44	0.5083
Scale		0	1.5126	0.0000	1.5126	1.5126		

Looking at the type 3 analysis we can see that treatment and tribase (trichotomized baseline) are clearly significant where as age appears to not a be statistically significant effect for total count. Adjusting for over-dispersion does not change the parameter estimates, only the standard errors are different.

LR Statistics For Type 3 Analysis						
Source	Num DF	Den DF	F Value	Pr > F	Chi-Square	Pr > ChiSq
treatment	1	54	21.96	<.0001	21.96	<.0001
tribase	2	54	38.30	<.0001	76.60	<.0001
age	1	54	0.43	0.5125	0.43	0.5097

Problem 21

Using the model from Problem 20, what is the model-predicted mean falls count during the eight- week post-randomization interval for an individual having 5-10 baseline falls in the prior eight weeks, who is 80 years old, and was:

a

randomized to receive the experimental treatment

model-predicted mean falls count:
$exp(-.9326 + -.7427 + .3559 + 80 * .0288) = 2.677$

b

randomized to receive placebo

model-predicted mean falls count:
$exp(-.9326 + .3559 + 80 * .0288) = 5.625$

Problem 22

Regardless of your findings regarding over-dispersion in Problem 20, fit a negative binomial model to the total falls counts, with the same main effects as specified in Problem 20. For each parameter in the model, report the estimate, standard error, test statistic, and p-value. Compare these results to those you found in your final model (i.e., adjusted for over-dispersion, if necessary) in Problem 20.

Fitting a negative binomial model to adjust for over-dispersion
Table of estimates, standard errors, test statistics, and p-values

Analysis Of Maximum Likelihood Parameter Estimates								
Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept		1	-0.4243	3.2150	-6.7255	5.8769	0.02	0.8950
treatment	1	1	-0.7254	0.1511	-1.0216	-0.4292	23.04	<.0001
tribase	1	1	0.3447	0.2233	-0.0929	0.7824	2.38	0.1226
tribase	2	1	1.5139	0.1804	1.1604	1.8674	70.44	<.0001
age		1	0.0223	0.0410	-0.0580	0.1027	0.30	0.5857
Dispersion		1	0.1284	0.0495	0.0603	0.2735		

Comparing the results of the two models the parameter estimates are very similar, the main difference is that the negative binomial model has a larger intercept (-.424 compared to -.933) and the negative binomial model has smaller standard errors, which leads to smaller confidence intervals.

Part 3

Problem 23

Fitting a repeated measures Poisson model wiht pairwise treatment interaction terms assuming an exchangeable working correlation structure
Model= treatment tribase age time treatment*tribase treatment*age treatment*time

Score Statistics For Joint Tests For GEE			
Source	DF	Chi-Square	Pr > ChiSq
treatment	1	0.72	0.3958
tribase	2	8.62	0.0134
age	1	0.02	0.8894
time	1	0.01	0.9289
treatment*tribase	2	0.25	0.8840
age*treatment	1	0.61	0.4343
treatment*time	1	6.02	0.0141

The Score statistics for Type 3 GEE Analysis Tests show that only the treatment*time interaction is significant. Refitting the model with the treatment*time interaction
Table of parameter estimates

Analysis Of GEE Parameter Estimates								
Empirical Standard Error Estimates								
Parameter			Estimate	Standard Error	95% Confidence Limits		Z	Pr > |Z|
Intercept			-1.9334	2.3177	-6.4759	2.6092	-0.83	0.4042
treatment	1		-0.4637	0.1359	-0.7301	-0.1974	-3.41	0.0006
tribase	1		0.3835	0.1904	0.0104	0.7566	2.01	0.0439
tribase	2		1.5341	0.2047	1.1329	1.9353	7.49	<.0001
age			0.0328	0.0295	-0.0250	0.0905	1.11	0.2661
time	2		-0.0160	0.1813	-0.3713	0.3393	-0.09	0.9297
treatment*time	1	2	-0.6771	0.2251	-1.1184	-0.2359	-3.01	0.0026

Problem 24

For this problem, you should restate your final recommended model from Problem 23 at the top of the page for the grader's reference. Using this final model, provide the falls rate ratio comparing experimental treatment and placebo at each post-randomization period (i.e., for Weeks 1-4 and separately for Weeks 5-8), and provide the corresponding 95% confidence intervals for these estimates.

Final Model= treatment tribase age time treatment*time
Weeks 1-4 rate ratio=.629 95% CI:(.482, .821)
Weeks 5-8 rate ratio=.32 95% CI:(.195, .525)

Problem 25

For this problem, you should restate your final recommended model from Problem 23 at the top of the page for the grader's reference. Provide the predicted mean falls count at the Week 5-8 interval for an individual having 5-10 baseline eight-week falls, who is 80 years old, and was: Final Model= treatment tribase age time treatment*time

a

randomized to the experimental treatment arm

Predicted mean falls
count=$exp(-.016 + .0328 * 80 + .3835 + -1.9334 + (-.4637 + -0.6771)) = .921$

b

randomized to the placebo arm

Predicted mean falls count=$exp(-.016 + .0328 * 80 + .3835 + -1.9334) = 2.881$