**AMS 588 Practice Midterm Exam Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Survival Analysis**

**Fall 2018 SBU-ID: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

1. (25 points) Suppose that the mean residual life of a continuous survival time *X* is given by *mrl* (*x*) *x* 10.

a) Find the mean of *X*.

b) Find the hazard function *h*(*x*).

c) Find the survival function *S*(*x*).

1. (25 points) Consider the log linear model

for a life time *X* with a covariate vector . Assume that is distributed with the following density function

Show that *X* is Weibull distributed if .

1. (25 points) The following questions are related to Cox Regression Model:

a) Describe the Cox regression model.

b) Why this is a semi-parametric model?

c) Why the Cox model is often called a proportional hazards model? Explain it well.

d) What does it mean that the observations are tied?

e) Describe the Breslow partial likelihood.

4. (25 points) The following small data set contains the survival and covariate information from 6 patients

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
| 3 | 1 | 7 | 2 |
| 2 | 0 | 6 | 4 |
| 1 | 1 | 4 | 9 |
| 4 | 1 | 5 | 8 |
| 5 | 0 | 10 | 3 |
| 6 | 1 | 9 | 6 |

where time to failure or censoring; failure indicator; 1 = failure, 0 = censored; = observed values of covariates. Assume a proportional hazards model

1. Write out the SAS or R code to fit the proportional hazards model.
2. Give out the partial likelihood function and show that it has a unique maximum.
3. Suppose that after fitting the model, you have the following output:

| **Analysis of Maximum Likelihood Estimates** | | | | | | |
| --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | **DF** | **Parameter Estimate** | **Standard Error** | **Chi-Square** | **Pr > ChiSq** | **Hazard Ratio** |
| z1 | 1 | -0.87757 | 0.49210 | 3.1802 | 0.0745 | 0.416 |
| z2 | 1 | -0.26680 | 0.34740 | 0.5898 | 0.4425 | 0.766 |

| **Estimated Covariance Matrix** | | |
| --- | --- | --- |
| **Parameter** | **z1** | **z2** |
| z1 | 0.242 | 0.125 |
| z2 | 0.125 | 0.121 |

What inferences can you make about and ?