Math 473 Quiz 7 Spring 2017 Name___________________

1) Suppose 20 items were tested for 75 hours. Suppose that the failure times given below follow an exponential (λ) distribution.

r = # uncensored

17, 25, 27, 30, 50, 66,
75+, 75+, 75+, 75+, 75+, 75+, 75+,
75+, 75+, 75+, 75+, 75+, 75+, 75+

a) Find $\hat{\lambda}$. $= \dfrac{\sum_{i=1}^{n} \delta_i}{\sum_{i=1}^{n} Y_i^*} = \dfrac{r}{\sum Y_i^*} = \dfrac{6}{17+25+27+30+50+66+14(75)}$

$= \dfrac{6}{1265} = \boxed{0.004743}$

b) Find a 95% CI for λ. $\hat{\lambda} \pm 1.96 \dfrac{\hat{\lambda}}{\sqrt{r}} = 0.004743 \pm \dfrac{1.96(0.004743)}{\sqrt{6}}$

$= 0.004743 \pm 0.003795 =$

$\boxed{(0.0009478, 0.008538)}$

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2) Does the cox.zph function output below suggest that the proportional hazards assumption is reasonable?

```
z<-coxph(Surv(edrel,rel)~histol+instit+age+stage,data=nwtco)
cox.zph(z)
          rho chisq        p
histol -0.0742  2.94 8.66e-02
instit -0.0456  1.06 3.02e-01
age     0.2082 29.66 5.16e-08
stage  -0.1489 11.83 5.84e-04
GLOBAL      NA 53.85 5.66e-11
```

p ← pvalue

$< .05$ so $\boxed{\text{no}}$

or

pval > $\delta = 0.05 \Rightarrow$ PH assumption is reasonable

pval < $\delta = .05 \Rightarrow$ $\boxed{\text{PH assumption is unreasonable}}$

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```
Full Model: Loglik(model)= -31.3 Loglik(intercept only)= -39.3
Chisq= 15.82 on 5 degrees of freedom, p= 0.0074
```

Reduced Model:	Value	Std. Error	z	p
Intercept	7.2972	1.5493	4.710	0.000
treat	0.4341	0.4633	0.937	0.3490
size	-0.0370	0.0174	-2.126	0.0335
index	-0.2692	0.1162	-2.317	0.0205
Log(scale)	-0.9901	0.3489	-2.837	0.00455

```
Loglik(model)= -31.4   Loglik(intercept only)= -39.3
        Chisq= 15.64 on 3 degrees of freedom, p= 0.0013
```

3) Prostate cancer data is from Collett (2003, p. 10). The full model has 5 predictors, *treat* (placebo or DES), *size* of tumor, Gleason *index* for tumor, *age* and *serum*. Output is from a Weibull regression.

a) For the reduced model, test whether $\boldsymbol{\beta} = \mathbf{0}$. $H_0\ \beta = 0 \quad H_A\ \beta \neq 0$

use output

$\boxed{\begin{array}{l} X^2(\text{U}|\text{F}) = 15.64 \\ \text{pval} = 0.0013 \end{array}}$ $\approx [-2(-39.3)] - [-2(-31.4)] = 78.6 - 62.8 = 15.8$

$= P(X^2_3 > 15.64) =$

df	.005	.001
3	12.84	16.27

$.001 < \text{pval} < .005$

reject H_0 there is a WPH survival relationship between Y and the predictors treat, size and index

b) Test whether $\beta_1 = 0$.

$H_0\ \beta_1 = 0 \quad H_A\ \beta_1 \neq 0$

$z_{o1} = 0.937$

$\text{pval} = 0.349$

fail to reject H_0, treat is not needed in the WPH survival model given size and index are in the model

c) Test whether $\beta_2 = 0$.

$H_0\ \beta_2 = 0 \quad H_A\ \beta_2 \neq 0$

$z_{o2} = -2.126$

$\text{pval} = 0.0335$

reject H_0 size is needed in the WPH survival model given treat and index are in the model.

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