STAT 575
Homework 10 Problems
due Wednesday April 28

3 Problems. Show all work.

The numbers refers to *Cunningham et.al*, if not specified otherwise. Some problems may have additional parts.

(For help with R, see Lab1 Part I and the R code for plotting SDFs, both linked off the course calendar.)

Include your R code used to make the plots. Please follow the lab report directions linked off the Homework page.

1. In R, plot the function given in the Extra Problem for Homework 2, p. 76, Problem 3.4 (a). Be sure to give a title to your plot.

2. p. 77, 3.9 (d). The PDF of the Chi-squared Distribution with r degrees of freedom is given. We will use R to plot the PDF, CDF, SDF and the hazard rate function (HRF) with $r = 3$ (not $r = 2$). You do not have to find the equation of the hazard rate function, just make the following 4 plots:

Note: You can make all 4 plots below on one page by using the R `par` command below, before you make plots.

```
> par(mfrow=c(2,2))
```

1) Create a sequence of values of x from 0 to 10. Use the R function `dchisq` to plot the PDF, $f_X(x)$ with $r = 3$. Be sure to give a title to your plot.

2) Create a sequence of values of x from 0 to 10. Use the R function `pchisq` to plot the CDF, $F_X(x)$ with $r = 3$. Be sure to give a title to your plot.

3) Create a sequence of values of x from 0 to 10. Use R to plot the SDF, $S_X(x)$ with $r = 3$. Be sure to give a title to your plot.

4) Create a sequence of values of x from 0 to 10. Use R to plot the HRF, $\lambda_X(x)$ with $r = 3$. Be sure to give a title to your plot.

3. We will use a Markov Chain to model of cumulative damage sustained by a system over time. Let the system be an automobile, and suppose that auto begins in excellent condition (State 1). As the auto is driven, its condition deteriorates due to mechanical wear-out and such environmental factors as road bumps and weather. The automobile will pass through States 2, 3, and 4 (good, fair, and poor) on its way to the junk pile (State 4). Suppose the yearly transition from one state to another is a Markov Chain with one-step probability transition matrix P.

```
> P
     [,1] [,2] [,3] [,4]
[1,]  0.7  0.3  0.0  0.0
[2,]  0.0  0.6  0.4  0.0
[3,]  0.0  0.0  0.5  0.5
[4,]  0.0  0.0  0.0  1.0
```

(a) In R, make the transition probability matrix P, Q, and QT for the above Markov Chain.

(b) Find the probability that the automobile goes from excellent condition (State 1) to poor condition (State 4) in 7 years.

(c) If an automobile is currently in excellent condition (State 1), find the expected number of visits to each of States 1, 2, and 3 before reaching the absorbing State 4.

(d) If an automobile is currently in excellent condition (State 1), what is the probability that the automobile ends up in the junk pile (State 4) in this process?