

## MAT 2377 (Winter 2014)

### Assignment 4

Due on March 20 in boxes in Mathematics department at 3pm).

**Note :** You must give complete details in your solutions. To receive points for the question, you must clearly justify your final answer.

1. Please answer the following 4 questions from the textbook.

7.27, 8.6, 8.14, 8.16, 8.36 (use R for 8.36).

**Remark :** If  $x$  is a numerical variable in R. Then the command  $t.test(x)$  will give a 95% confidence interval for the mean based on  $t$ . Use this command in Exercise 8.36.

2. **[R Problem]** : We will generate observations for Bernoulli trials each with a probability of success of  $p = 0.45$ . Generate 5000 rows, each of size 200 columns. Each row can be considered as a random sample of size  $n = 200$  from a Bernoulli distribution with  $p = 0.45$  (or equivalently as a binomial with  $n = 1$  and  $p = 0.45$ ). Compute the sample mean  $\bar{x}$  row-wise. So you should have 5000 sample means. Assess the normality of this sample of samples means with a histogram and the overlay of the density of the normal distribution that corresponds to the approximate sampling distribution of the sample mean. What is the theoretical result illustrated by this procedure?

Repeat the same experiment with an exponential distribution with mean 1 and uniform distribution on  $[0, 2]$ . Use

```
rexp(5000*200,1)
```

and

```
runif(5000*200,0,2)
```

in line 1 of the following program for the exponential and the uniform distribution, respectively.

Here is the short program in R for Bernoulli observations.

```
#Bernoulli trials
x=rbinom(5000*200,1,0.45)
# 5000 samples of size 200 stored in a 5000 by 200 matrix
A=matrix(x,ncol=200)
# calculates the proportion of 1's for each row
means=apply(A,1,mean)
```

```
#draws density histogram for sample means to check normality
hist(means,prob=TRUE)
#overlay a normal density
xnrm <- seq(min(means),max(means),length=40)
ynrm <-dnrm(xnrm,mean=0.45,sd=sqrt((0.45)*(1-0.45)/200))
lines(xnrm, ynrm, lwd=2)
```

*Hint* : You will need to modify the parameters for the normal density, see *ynrm* above, for the exponential and the uniform. What is the approximate sampling distribution for the sample mean in those cases?