Statistics 302 Spring 2014 Larget Assignment #6 posted March 3, 2014

Due Friday, March 14

Textbook Exercises

5.29, 5.32, 5.36, 5.62, 5.64, 5.75, 11.30, 11.36, 11.39, 11.58, 11.60

Computer Exercises

For each R problem, turn in answers to questions with the written portion of the homework. Send the R code for the problem to Katherine Goode. The answers to questions in the written part should be well written, clear, and organized. The R code should be commented and well formatted.

R problem 1 The function `pnorm()` finds probabilitites from normal distributions. By default, it returns the area to the left from the standard normal density, bu the second and third arguments can be used to specify a different mean or standard deviation. So, here are various ways to calculate the area to the right of 650 from a $N(500, 100)$ distribution.

```
1 - pnorm(650, 500, 100)

## [1] 0.06681

1 - pnorm(650, mean = 500, sd = 100)

## [1] 0.06681

1 - pnorm((650 - 500)/100)

## [1] 0.06681
```

The function `qnorm()` finds quantiles from a normal distribution. Again, without other arguments, it uses the standard normal distribution.

```
qnorm(0.9)

## [1] 1.282

qnorm(0.9, mean = 500, sd = 100)

## [1] 628.2
```

Write an expression using `pnorm()` and or `qnorm()` to find each of the following values. Note, we are using the notation $N(\mu, \sigma)$ to represent a normal distribution with parameters μ for the mean and σ for the standard deviation (and not using $N(\mu, \sigma^2)$).

For all problems, use the $N(250, 30)$ distribution.

1. $\mathsf{P}(X < 200)$.
2. $\mathsf{P}(X > 260)$.
3. $\mathsf{P}(|X - 250| > 40)$.
4. $\mathsf{P}(260 < X < 300)$.

5. The number c so that $\mathsf{P}(X < c) = 0.9$.
6. The number c so that $\mathsf{P}(X > c) = 0.24$.
7. The number c so that $\mathsf{P}(|X - 250| > c) = 0.18$.
8. The number c so that $\mathsf{P}(X - 250| < c) = 0.9$.

R problem 2 The height of the density function of a normal curve can be computed with the R function `dnorm()`. Write a function called `anorm()` that will draw a sketch of a normal density and shade in the two tails with probability $\alpha/2$ if one passes in a mean, sd, and alpha value. Modify this function which calculates and draws $\mathsf{P}(X \leq a)$.

```
gnorm = function(a,mu=0,sigma=1) {
    # create an array of x values of length 501
    # from 4 SDs below to 4 SDs above the mean
    x = seq(mu-4*sigma,mu+4*sigma,length=501)
    # calculate the height of the normal density at these points
    y = dnorm(x,mean=mu,sd=sigma)
    # put x and y into a data frame
    d = data.frame(x,y)
    # create a plot that graphs the normal density
    # and overlays this with a horizontal line for the x axis
    # store the plot as the object p and later add more to it
    require(ggplot2)
    p = ggplot(d, aes(x=x,y=y)) + geom_line() +
        geom_segment(aes(x=mu-4*sigma,xend=mu+4*sigma,y=0,yend=0),
            data=data.frame(mu,sigma)) +
        ylab('density')
    # shade in the area
    # add points to the data frame d that are the bottom of the segment to shade
    # and extract only those x and y from d where x <= a
    d2 = data.frame(x = c(mu-4*sigma,x[x<=a],a), y = c(0,y[x<=a],0))
    p = p + geom_polygon(aes(x=x,y=y),data=d2,fill="red") +
        ggtitle(paste("P(X <",a,") =",round(pnorm(a,mu,sigma),4)))
    plot(p)
}
```