Homework # 5

For this week's homework, we will revisit some old homework problems. But this time we'll use R to solve them (*you **must** use R to do problems 1 - 5*). We'll also collect a little data in class.

1) Find the following probabilities:

a) Pr{$Z < 4.73$} b) Pr{$Z > 1.77789$} c) Pr{$-2.22 < Z < 0.11$} d) Pr{$-0.27 < Z < 0.7435$}

e) Pr{$Z < -0.27$ or $Z > 0.7435$} (you want the probability outside the range − 0.27 to 0.7435)
(Hint: you can use the answer from (c) to help you with this)

To get probabilities (areas) in R, you can do the following from the command line:

To get, for example, the $Pr\{Z < 1.90\}$, you can do:

```
pnorm(1.90)
```
(R should return 0.9712834)

You can also, of course, do simple subtractions in R. For example, to get $Pr\{-1.90 < Z < 1.90\}$ you could do:

```
pnorm(1.90) - pnorm(−1.90)
```

To get *z* values in R (technically, "quantiles"), you can do the following from the command line:

To get the *z* for which corresponds to 90% of the area in the lower tail,
(i.e., to get *z* in $\Pr\{Z < z\} = .90$, do:

```
qnorm(.90)
```
R should return 1.281552

(In other words, if $z = 1.281552$, then 90% of the area under the normal curve will be less than *z*)

Be prepared to show your R-printout if asked.

2) *(Remember: use R):* Let's continue our investigations of the caracal (*Caracal caracal*) . Remember that somehow we know that $\mu = 13.5$ kg and $\sigma = 2.25$ kg.

a) $Pr\{Y > 18.5\}$ b) $Pr\{Y < 10.8\}$ c) $Pr\{11.3 < Y < 17.3\}$

One nice thing about R is that you don't need to worry about converting to z. R does all the work for you. For example, if you want to get the probability a caracal is less than 10 kg you can do:

```
pnorm(10, mean = 13.5, sd = 2.25)
```

This will give you the probability that $Y < 10$. **This also works with `qnorm`.**

3) Refer to problem (2). Give the following quantiles *(use R)*:

a) .3333 (=33.33th percentile; same for the remaining parts) b) .999 c) .50

d) 0.00001 e) 0.1150697 f) compare (e) to 2(b). Are you surprised? ***Why or why not - explain!***

4) Just before ovulation, estrogen (estradiol, actually) levels in women average about 398 pg/mL (we'll assume $\mu = 398$ pg/ML). Let's assume the standard deviation is about 79 pg/mL (so $\sigma = 79$ pg/mL)

a) Give the blood calcium values for the middle 20% of women.

b) Give the blood calcium values for the middle 90% of women.

c) Give the 95th percentile.

5) In the U.S., about 15% of people are Rh negative for blood type. You take a sample of size 11. Use R to calculate the following probabilities:

a) $\Pr\{Y = 3\}$ b) $\Pr\{Y = 6\}$

You should be able to figure this out using the R-instructions for the binomial from the last two homework assignments. However, here's just a brief refresher:

To get a binomial probability, just do (this would, for example, be the probability of 8 heads in 10 tosses):

```
dbinom(8,10,.5)
```

(Problems 6 & 7 on next page)

Problems 6 and 7 can not be done until your recitation (or lab) section meets (don't worry - they won't be due until the following recitation/lab):

You need to meet to collect the data to do 5 and 6.

You won't be discussing 5 and 6 in class when the rest of this homework is due. Instead, you'll have until the next recitation to finish them and turn them in. You might want to make sure you know how to do them before you leave, though.

6) Collect the following data in class:

a) height b) sex c) right handed or left handed.

It's okay if no one is left handed, but usually there will be a few people.

Enter the data into R and give summary statistics for height (mean, standard deviation, variance). Make a boxplot and histogram of the data.

Refer to the R notes from previous homeworks to figure out how to enter the data in R (or enter data in Excel and then move them to R). Previous homeworks also have information on boxplots and histograms.

There's also a chapter in the text that discusses R concepts such as importing and exporting data and generating summary statistics. The text also has R commands in the appropriate portions of the text.

7) Let's assume our class is truly representative of the population at large.

(a) Calculate the probability of having three right handed people in a sample of 10. Do this using R.

(b) repeat, but this time calculate the probability of 3 or less right handed people in a sample of 10.

You should know how to do this in R by now (see problem 4 for a small hint).

(Hint and caution: what is your *p*? It is NOT 0.5)

Be prepared to discuss problems 1 - 5 in recitation the week of March 3rd.

Problems 6 & 7 will be due in recitation the following recitation.