Homework # 5

Note: Please circle your answers as appropriate.

Remember - for all problems, show your work!

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.

As usual, information on how to use R is at the end.

1) Find the following probabilities:

a) $\Pr\{Z < -5.12\}$ b) $\Pr\{Z > -1.276\}$ c) $\Pr\{-2.222 < Z < -0.555\}$

d) $\Pr\{0.000 < Z < 1.6449\}$ e) $\Pr(-6.00 < Z < 1.6449)$

Be prepared to show your R-printout if asked.

2) *(Remember: use R):* Let's continue our investigations of the Blue whale (*Baleonoptera musculus*) heart weights. Remember that somehow we the true average weight (μ) is 181.4 kg ($\mu = 181.4$ kg) and that the true standard deviation (σ) is 23 kg ($\sigma = 23$ kg)

a) $Pr\{Y > 225.4\}$ b) $Pr\{Y < 169.3\}$ c) $Pr\{199.2 < Y < 205.8\}$

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

a) .678 (=67.8th percentile; same for the remaining parts) b) .907 c) .50

d) 0.0001 e) 0.2994139 f) compare (e) to 2(b). Are you surprised? ***Why or why not - explain!***

4) In parts of Puerto Rico, densities for the coquí (*Eleutherodactylus coqui*, a small frog) reach about 20,000 frogs per hectare ($\mu = 20{,}000$). Let's assume a standard deviation of 2,150 for these areas of Puerto Rico ($\sigma = 2{,}150$ frogs/hectare). Use R.

a) Give the numbers of frogs for the middle 50% of hectares.

b) Give the numbers of frogs for the middle 90% of hectares.

c) Give the 95th percentile.

5) Let's get some Poisson distribution probabilities. You want to catch and mark spotted turtles (*Clemmys guttata*). From experience you know that you can catch 5 turtles per day ($\mu = 5$). Let Y = number of turtles caught in a day. Use R to calculate the probabilities of catching:

a) $\Pr\{Y = 3\}$ b) $\Pr\{Y = 5\}$

To get a Poisson probabilities in R you use the `dpois` command. If, for example, you wanted to find the probability of a cat having 4 ticks and you know the true average number of ticks/cat is 2, you would do:

```
dpois(4,2)
```

(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) 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, median, 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 five right handed people in a sample of 6. Do this using R.

(b) repeat, but this time calculate the probability of 3 or less right handed people in a sample of 6.

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 2nd.

Problems 6 & 7 will be due in recitation the following week (week of Mach 16th).

(The following week is after spring break)

Normal probabilities and quantiles with R:

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 quantiles (percentiles) in R (you want the values for z) you can do the following from the command line:

For the 90th quantile (90th percentile), (you want 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)

One nice thing about R is that you don't need to worry about converting to z (or y). R does all the work for you.

For example, somehow you know the true average weight (μ)of caracals (a cat from Africa) is 13.5 kg, and the true standard deviation (σ) is 2.25 kg. You want to get the probability a caracal is less than 10 kg, in R you can do:

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

Which will give you the probability that $Y < 10$.

This also works with `qnorm`; for example, to get the 95th quantile for caracals:

```
qnorm(.95, mean = 13.5, sd = 2.25)
```

(For Poisson probabilities, see problem 5)