Homework #3

For a problem that asks you to use R, include a copy of the code and output.

1. To celebrate their 30th birthdays, brothers Mario and Luigi of the Nintendo *Mario* video game franchise wish to study the distribution of heights of their mushroom enemies, the Goombas. Their reasoning is that shorter Goombas are easier to jump on. (Goombas die when Mario and Luigi jump on them.)

(a) If we assume that the population of Goomba heights are normally distributed with mean 12 inches and standard deviation 6 inches, what is the probability that a randomly chosen goomba has a height between 13 and 15 inches?

(b) Koopa Troopas, other enemies of Mario & Luigi, have a mean height of 15 inches with standard deviation 3 inches. What is the probability that a randomly chosen Koopa Troopa is taller than 75% of Goombas?

2. The Hereford Cattle Society says that the mean weight of a one-year-old Hereford bull is 1135 pounds, with a standard deviation of 97 pounds. Suppose 40 bulls are randomly selected and loaded on a train car. Find the probability their combined weight exceeds 46000 pounds. (Hint: The combined weight exceeds 46000 pounds if the average weight exceeds $\frac{46000}{40} = 1150$ pounds.)

3. Let $F$ be an RV that represents the operating temperature in Fahrenheit of one instance of a manufacturing process, and let $F \sim N(90,5^2)$. Let $C$ be an RV that represents the same process, but measured in Celsius. Fahrenheit can be converted to Celsius using $C = \frac{5}{9}(F - 32)$. (I recommend doing these with a calculator and $N(0,1)$ table as practice for the exam. Then check your answers with R if you wish.)

(a) Find the probability that one randomly selected instance of the process will have operating temperature greater than 93.8 Fahrenheit.

(b) $C$ is also normally distributed. Find its mean and variance.

(c) Find the probability that one randomly selected instance of the process will have operating temperature below 29 Celsius.

(d) Find the Celsius temperature $x$ such that the probability that the operating temperature in Celsius of one instance is less than $x$ is .25.

4. A simple random sample was taken of 44 water bottles from a bottling plant’s warehouse. The dissolved oxygen content (in mg/L) was measured for each bottle, with these results:

11.53, 8.35, 11.66, 11.54, 9.83, 5.92, 7.14, 8.41, 8.99, 13.81, 10.53, 7.4, 6.7, 8.42, 8.4, 8.18, 9.5, 7.22, 9.87, 6.52, 8.55, 9.75, 9.27, 10.61, 8.89, 10.01, 11.17, 7.62, 6.43, 9.09, 8.53, 7.91, 8.13, 7.7, 10.45, 11.3, 10.98, 8.14, 11.48, 8.44, 12.52, 10.12, 8.09, 7.34

Here the sample mean is 9.14 mg/L and the sample standard deviation is 1.78 mg/L.

The population standard deviation of the dissolved oxygen content for the warehouse is known from long experience to be about $\sigma = 2$ mg/L.

(a) Find a 98% confidence interval for the unknown population mean dissolved oxygen content.

(b) Interpret your interval.