Question 10.45

a. $\alpha = 0.01$
b. $H_O : \mu = 50000$, $H_A : \mu > 50000$, where μ is the mean number of raptors seen in all years.
c. A one-sample Z-test is required because a quantitative variable (number of raptors) was measured on individuals from one population (all years at Hawk's Ridge) and σ is known (given in background).
d. An observational sample that was not random (i.e., years were consecutive) was taken.
e. The assumptions are met because $n > 30$ and σ is known.
f. $\bar{x} = 68183.1$ (Table 1).

Table 1. Results from the one-sample z-test for testing that the mean number of hawks observed at Hawk Ridge, MN is greater than 50000 per year.

```
z = 2.78, n = 32.000, Std. Dev. = 37000.000, Std. Dev. of the sample mean =
6540.738, p-value = 0.002718
99 percent confidence interval:
 52967.06      Inf
sample estimates:
mean of hr$Total
        68183.09
```

g. The test statistic is z =2.780 (Table 1).
h. The p-value is $p = 0.0027$ (Table 1).
i. The H_O is rejected because the $p - value < \alpha$.
j. The number of raptors seen per year appears to be greater than 50000.
k. A 99% lower confidence bound is required. Thus, one is 99% confident that the mean number of raptors seen per year for ALL years is more than 52967 (Table 1).

Question 10.46

a. $\alpha = 0.10$.
b. $H_O : \mu = 630$, $H_A : \mu > 630$, where μ is the mean credit card limit for all companies.
c. A one-sample Z-test is required because a quantitative variable (credit score) was measured on individuals from one population (all credit card companies) and σ is known (given in background).
d. An observational sample, with no evidence of randomness, was selected.
e. The assumptions are met because $n > 30$ and σ is known.
f. The statistic is $\bar{x} = 636.86$.
g. The test statistic is $z = \frac{636.86-630}{\frac{5}{\sqrt{44}}} = 9.11$
h. The p-value is $p < 0.00005$.
i. The H_O is rejected because the $p - value < \alpha$.
j. It appears that the credit card companies have increased the threshold for issuing a credit card.
k. A 90% lower confidence bound with Z^* =-1.282. Thus, $636.86 - 1.282\frac{5}{\sqrt{44}}$ or $636.86 - 0.97 = 635.89$. Therefore, one is 90% confident that the mean cutoff score for ALL companies is greater than 635.89.

Question 10.47

a. $\alpha = 0.10$
b. $H_O : \mu = 8$, $H_A : \mu > 8$, where μ is the mean elk density.
c. A 1-sample Z-test is required because a quantitative variable (elk density) was measured on individuals from one population (plots in Banff National Park) and σ is known (given in background).
d. An observational sample that is not obiously random was selected.
e. The assumptions are met because $n = 15$ and population is approximately normal and σ is known.
f. The statistic is $\bar{x} = 9.35$ (Table 2).

Table 2. Results from the one-sample z-test for testing that the mean density of elk is greater than 8 per km^2.

```
z = 2.6194, n = 15.000, Std. Dev. = 2.000, Std. Dev. of the sample mean =
0.516, p-value = 0.004404
90 percent confidence interval:
 8.690876      Inf
sample estimates:
mean of elkdens
       9.352667
```

g. The test statistic is z =2.619 (Table 2).
h. The p-value is $p = 0.0044$ (Table 2).
i. The H_O is rejected because the $p - value < \alpha$.
j. The annual density of elk appears to be greater than 8 per square km.
k. A 90% lower confidence bound is required. Thus, one is 90% confident that the mean annual density of elk is more than 8.69 per square km (Table 2).

Question 10.48

[**2 pts**] A total of **68 plots** would be required. We were given a m.e.=10, σ=50, and z*=1.645. With this, the sample size is calculated with $n = \left(\frac{1.645*50}{10}\right)^2 = 67.65$. In sample size calculations we always round up.

Appendix – R Commands

```
hr <- read.csv("data/HawksRidge.csv")
( z.test(hr$Total,mu=50000,sd=37000,alt="greater",conf.level=0.99) )
```

```
( distrib(636.86,mean=630,sd=5/sqrt(44),lower.tail=FALSE) )
( distrib(0.90,type="q",lower.tail=FALSE,lower.tail=FALSE) )
```

```
elkdens <- c(5.20,7.79,6.46,8.60,8.97,8.65,9.60,9.09,12.42,10.70,11.59,10.68,10.61,9.04,10.89)
( ed.z <- z.test(elkdens,mu=8,sd=2,alt="greater",conf.level=0.90) )
```

```
( distrib(0.95,type="q") )
```

Notes From Professor

- There must be a table of output from `z.test()` for the problems that require R. You must then label this table and refer to it directly for steps 6, 7, 8, and 11.
- In step 11, one must refer to the values of the confidence interval, lower bound, or upper bound. One does not refer to the specific value from the null hypothesis when interpreting the confidence region.
- Make sure to provide evidence for your statements. Don't just say "the sample is large", rather say " the sample is large because n=32 > 30." In addition, don't just say "... because a quantitative variable was measured on one population", rather say " a quantitative variable (number of hawks) was measured on one population ('Hawk's Ridge')."
- It is not possible for the p-value to be zero. If the p-value is very small (i.e., less than a rounded 0.0001) then we write "p < 0.00005."
- Sample size calculations must be rounded UP, no matter the value of the first decimal.
- Do not say "sample population" as there is no such thing. There is a "sample" (of the population) and there is a "population" but there is no "sample population."
- Be specific about which distribution you are referring to ... it is the population distribution in a 1-sample z-test.