Supplement–Midterm II

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I will try to reach a parametric equasion that includes b, a, and n. I will then solve for each value of n that are asked for. First, from the cdf for a N(100, 15/sqrt(n)) distribution I have:

$$P(\bar{X} < q) = 1 - a \Rightarrow P(\frac{\bar{X} - 100}{15/\sqrt{n}} < \frac{q - 100}{15/\sqrt{n}}) = 1 - a \Rightarrow F_Z(\frac{q - 100}{15/\sqrt{n}}) = 1 - a \Rightarrow q = \frac{15}{\sqrt{n}} F_z^{-1}(1 - a) + 100$$

Where F_Z^{-1} is the inverse cdf of the standard normal. Assuming now that our initial X derives from a N(105, 15/sqrt(n)) as we did in class, we have a second equation:

$$F(q) = b \Rightarrow F_Z(\frac{q - 105}{15/\sqrt{n}}) = b \Rightarrow q = \frac{15}{\sqrt{n}} F_z^{-1}(b) + 105$$

If we equate and solve for n and alpha = .05 we have:

$$n = 9(F_z^{-1}(1 - a) - F_z^{-1}(b))^2 \Rightarrow n = 9(1.64 - F_z^{-1}(b))^2$$

I can also generalize this equasion to:

$$n = \frac{\sigma^2}{(difference\ in\ means)^2}(F_z^{-1}(1 - a) - F_z^{-1}(b))^2$$

Using r we have:

```r
n_power <- function(a, b){
  9*(qnorm(1-a) - qnorm(b))^2
}

ceiling(n_power(.05, .3))
```

```
## [1] 43
```

```r
ceiling(n_power(.05, .2))
```

```
## [1] 56
```

```r
ceiling(n_power(.05, .05))
```

```
## [1] 98
```