100Ω Resistances

X_1	99.64	X_{43}	99.67
X_2	99.53	X_{44}	99.44
X_3	99.37	X_{45}	99.72
X_4	99.79	X_{46}	99.3
X_5	99.58	X_{47}	99.35
X_6	99.82	X_{48}	99.33
X_7	99.13	X_{49}	99.7
X_8	99.56	X_{50}	99.43
X_9	100.46		
X_{10}	99.65		
X_{11}	99.25		
X_{12}	99.6		
X_{13}	99.32		
X_{14}	99.48		
X_{15}	99.92		
X_{16}	99.23		
X_{17}	99.69		
X_{18}	99.38		
X_{19}	100.32		
X_{20}	99.79		
X_{21}	99.9		
X_{22}	99.75		
X_{23}	99.10		
X_{24}	99.56		
X_{25}	99.78		
X_{26}	99.42		
X_{27}	99.7		
X_{28}	99.74		
X_{29}	99.47		
X_{30}	99.54		
X_{31}	99.83		
X_{32}	99.62		
X_{33}	99.83		
X_{34}	99.42		
X_{35}	99.77		
X_{36}	100.18		
X_{37}	99.04		
X_{38}	99.54		
X_{39}	99.13		
X_{40}	99.72		
X_{41}	99.25		
X_{42}	99.82		

1. I chose to do option B, X is the resistance of a 100Ω resistor, my assumption for μ is 99.8Ω and 90 for σ.

2. $$n \geq \left(\frac{z_{.95} \cdot 90}{100}\right)$$

This is the formula for the sample size when doing confidence interval for μ and with the desired Margin of Error.

$$n \geq \left(\frac{1.645 \cdot 90}{100}\right) = 1.5$$

It makes sense because you will rarely get anything far away from 100Ω, I decided to go with 50 samples.

3. My population came from the stockroom in the Merill Engineering Building up at the University of Utah. I purchased 50 100 ohm resistors and tested each one with the multimeter in the Analog Lab inside the same building.

5. $$\bar{X} = \frac{1}{n}\sum x_i = 99.5912$$

$$99.5912 - z_{.025}\left(\frac{90}{\sqrt{50}}\right) < \mu < 99.5912 + z_{.025}\left(\frac{90}{\sqrt{50}}\right)$$

$$z_{.025} = \pm 1.96$$

$$96.0632 < \mu < 103.12$$

6.

$$S^2 = \frac{1}{49}\sum (X_i - \overline{X})^2$$

Using Matlab I find that $S^2 = .0854$

So $S = \sqrt{S^2} = .292$

Its expected to have a low sample standard deviation since all data is close to mean.

$$99.5912 - t_{.025, V=49}\left(\frac{.292}{\sqrt{50}}\right) < \mu < 99.5912 + t_{.025, V=49}\left(\frac{.292}{\sqrt{50}}\right)$$

$$t_{.025} = 2.11$$

$$99.579 < \mu < 99.6$$

7.

$$99.8 - z_{.005}\frac{90}{\sqrt{50}} < \overline{X} < 99.8 + z_{.005}\frac{90}{\sqrt{50}}$$

$$z_{.005} = \pm -2.575$$

$$95.165 < \overline{X} < 104.435$$

Not rejected. Good test!