1. (a) By definition 7.8 in the notes substituting$n = 1$, if $X \sim N(0,1)$ and $Z \sim \chi_1^2$ with $Y \sim N(0,1)$ then by proposition 7.3.

$$|Y| = \sqrt{Y^2}$$
$$|Y| \sim \sqrt{Z}$$

Proposition 7.3. Then applying definition 7.8:

$$T = \frac{X}{\sqrt{\frac{Z}{1}}}$$
$$T = \frac{X}{|Y|}$$
$$T \sim t_1$$

And the proof is complete.

(b) t_1 10th perccentile $= 3.08$

2. (a) $t_{21,.99} = 2.518$ and $t_{21,.01} = -2.518$

$$[\frac{-2.158 * 8}{\sqrt{22}} + 82, \frac{2.518 * 8}{\sqrt{22}} + 82]$$
$$[77.7053, 86.2947]$$

(b) $z_{.01} = -2.32635$ and $z_{.99} = 2.32635$

$$[\frac{-2.32635 * 8}{\sqrt{250}} + 82, \frac{2.32365 * 8}{\sqrt{250}} + 82]$$
$$[80.8229, 83.1771]$$

(c) n is sufficiently large to make student's t distribution approach being normal.

3. (a) Chi squared distribution would be best since it's a compilation of multiple normal variables with a relatively low n.

(b) It's not symmetric about the mean.

4. (a)

$$\hat{p} \pm z_{\alpha/2}\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$
$$\hat{p} = .35$$
$$z_{\alpha/2} = 1.96$$
$$n = 100$$
$$[.302, .398]$$

(b)

$$\tilde{p} \pm z_{\alpha/2}\sqrt{\frac{\tilde{p}(1-\tilde{p})}{\tilde{n}}}$$
$$\tilde{p} = \frac{37}{104}$$
$$z_{\alpha/2} = 1.96$$
$$\tilde{n} = 104$$
$$[.309, .403]$$

(c)

$$\tilde{p} \pm z_{\alpha/2}\sqrt{\frac{\tilde{p}(1-\tilde{p})}{\tilde{n}}}$$
$$\tilde{p} = \frac{37}{104}$$
$$z_{\alpha/2} = 1.96$$
$$\tilde{n} = 104$$
$$[.309, .403]$$

(d) Wilson interval is based on Bayes and I'm a Bayes guy. It's tighter than the Wald interval.

5.

$$2\mu_X + \mu_Y \pm z_{\alpha/2}(\frac{\sigma}{\sqrt{n}} + \sqrt{3}\frac{\sigma}{\sqrt{m}})$$

6. (a)

$$\hat{\lambda} \sim N(0, \lambda^2)$$

(b)

$$\frac{\sqrt{n}\bar{X} - \mu}{s} \sim t_{n-1}$$

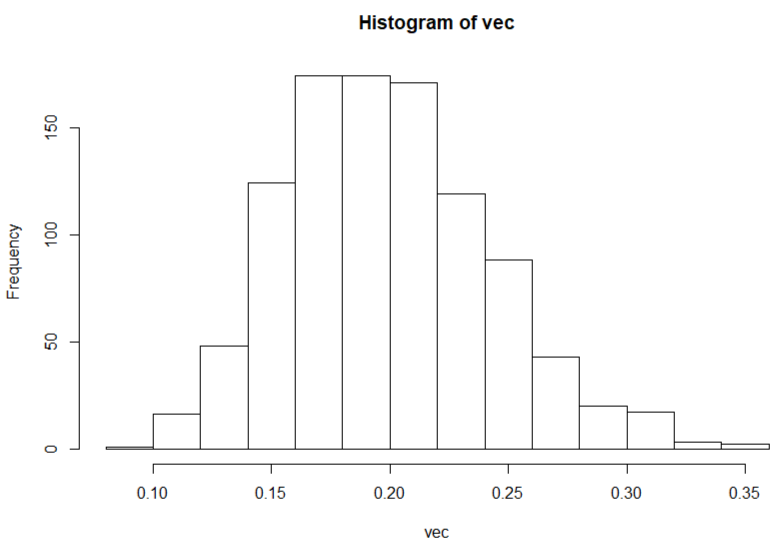
(c)

$$\frac{\hat{p} - p}{\sqrt{p(1-p)}} \sim N(0,1)$$

7. We can't be certain that we will wait longer at starbucks but the data indicates that some difference exists so: C

8. (a) 927

   (b) It's not quite as accurate as we'd like it to be ssince we should expect the histogram to be scewed.


Histogram of vec
Frequency
0
50
100
150
0.10
0.15
0.20
0.25
0.30
0.35
vec