COMP SCI/SFWR ENG 4/6E03 — Assignment 4 Solutions

1. (a) I used the t-tables to get $t_{[99;0.95]} \leq t_{[80;0.95]} = 1.664$. So the required CI is

$$\left(23.6 - \frac{(1.664)(7.0)}{\sqrt{100}}, 23.6 + \frac{(1.664)(7.0)}{\sqrt{100}}\right) = (22.4, 24.8).$$

(b) We need to find n such that

$$\frac{t_{[n-1;0.975]}}{t_{[99;0.95]}} \approx \frac{\sqrt{n}}{\sqrt{100}}.$$

Let's set $t_{[n-1;0.975]}$ to be 1.984 (the value for $n = 100$, the value does not vary much as n gets higher) to be conservative, so

$$\frac{1.984}{1.664} = \frac{\sqrt{n}}{\sqrt{100}}$$

which gives $n = 142$. So, on the order of 50 more samples are required.

(c) Using 90 percent confidence, the width would increase to

$$\frac{2(1.684)(7.0)}{\sqrt{49}} = 3.4.$$

This is an increase of 42 percent (from 2.4).

2. As the inverse of the inverse of a function is the function itself, simply take the inverse of the given function to yield:

$$F_X(x) = \begin{cases} 0 & x < 0 \\ x^2 & 0 \leq x \leq 1 \\ 1 & x > 1 \end{cases}$$

Note that a complete answer must include the domain, in particular the values for which x^2 is applicable (the other values can be inferred from this).

3. (a) Running the accompanying code with $\lambda = 1/6$ and $\mu = 1/10$ gives an average number of jobs in the system of 10.36. Note that this is for one run of 100000 – if I do additional runs, this value will vary. You should have played around with the simulation length until you see reasonable numbers. For example, for me 10000 was too short - it underestimates the value.

(b) See the accompanying code. I got an average here of 5.62, but again this will vary from run to run.