Answers to the 7th problem set exist in hand-written form. If you were not in class on April 26th, you can get a copy from the bulletin board outside room 2-384. Those answers omitted #4(c), which is therefore included here.

4. (c) Now reinstate the assumption that $n = 25$, but alter the alternative hypothesis, so that we have:

$$\begin{aligned} H_0 : &\quad \mu = \mu_0, \\ H_1 : &\quad \mu > \mu_0. \end{aligned}$$

Redo part (a) under these assumptions.

Answer: The null hypothesis $H_0 : \mu = \mu_0$ will be rejected if $\overline{X} - \mu_0 > c$, where the value of c is chosen so that $\mathbf{Pr}\left(\overline{X} - \mu_0 > c \mid H_0\right) = 0.05$. Since $\overline{X} \mid H_0 \sim N\left(\mu_0, \frac{1}{5^2}\right)$, we have $\dfrac{\overline{X} - \mu_0}{1/5} \sim N(0,1)$, and consequently

$$\mathbf{Pr}\left(\overline{X} - \mu_0 > c \mid H_0\right) = \mathbf{Pr}\left(\frac{\overline{X} - \mu_0}{1/5} > 5c \,\middle|\, H_0\right) = \mathbf{Pr}(Z > 5c) = 1 - \Phi(5c).$$

So we want

$$\begin{aligned} 1 - \Phi(5c) &= 0.05 \\ c = \Phi^{-1}(0.95)/5 &= \frac{1.645}{5} = 0.329. \end{aligned}$$