Name QUIZ ONE (JUNE 2012)
(IMSA Statistics)

Show your work –

(1) Claim: The mean starting salary for college graduates who have taken a statistics course is equal to \$46,000.
Sample data: $n = 65$, $\bar{x} = \$45{,}678$. Assume that $\sigma = \$9900$ and the significance level is $\alpha = 0.05$.

$\bar{x} = 45{,}678$
$n = 65$
$\sigma = 9{,}900$
$\alpha = 0.05$

(a) $H_0: \mu = 46000$

(b) $H_a: \mu \neq 46000$

(c) $TS = z = \dfrac{45678 - 46000}{9900/\sqrt{65}} = \dfrac{-322}{1227.9} = -0.262$

$\dfrac{\bar{x} - \mu}{\sigma/\sqrt{n}}$ page 381

(d) p-value = 0.3974 from Table A, page 684

See page 373 of book

$H_a: \mu \neq \mu_0$ is $2P(Z \geq |-0.262|)$

$2 * 0.3974$ = p-value for 2 sided H_a, two-tailed test.

$2 * 0.3974 = 0.7948$

(e) conclusion

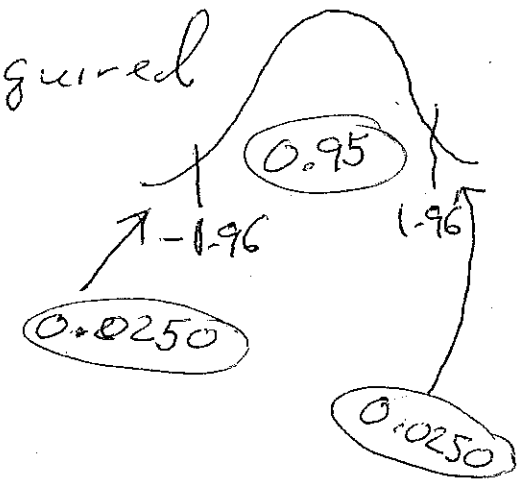
Since $0.7948 \not< 0.05 = \alpha$ value for 95% confidence

we don't have enough evidence to reject the Null hypothesis H_0. There isn't evidence to support salary being $\neq 46000$.

Follow-up question to quiz question

(f) How large a sample size would be needed to reject the $H_0: \mu = 46000$ if the $\bar{X}$ were still 45678?

(i) $Z \geq |-1.96|$ would be required



See Table A

$$\begin{array}{r} 0.0250 \\ +\ 0.95 \\ +\ 0.0250 \\ \hline 1.0000 \end{array}$$

Note: $Z \leq -1.96$ or $Z \geq 1.96$ is equivalent to $Z \leq |z|$ (absolute value of $z = |z|$)

(ii) Given or known:

Input

$\bar{X} = 45678$

$\mu_0 = 46000$

$\sigma = 9900$

$|Z| = 1.96$

Goal or need to know or try to find or unknown

Output

n

(iii) what will enable us to get from given (input) to goal (output)?

(page 3)

Mobilize past knowledge.
Can you think of a formula to apply?

(iv) Page 381 (Chapter 15 Summary)

$$Z = \frac{\bar{X} - \mu_0}{\sigma/\sqrt{n}}$$

$$-1.96 = \frac{45678 - 46000}{\frac{9900}{\sqrt{n}}}$$

$$\frac{(-1.96)(9{,}900)}{\sqrt{n}} = -322$$

$$\frac{(-1.96)(9{,}900)}{-322} = \sqrt{n} = \frac{-19404}{-322}$$

$$= 60.2$$

therefore $n = 60.2^2 = 3631.4$

(V) $\lceil 3631.4 \rceil = 3632$ is the smallest sample size that would be required to reject H_0 when the difference of $\bar{X}$ and μ_0 is 322 or -322.

$\lceil x \rceil$ is the ceiling function.

$\lceil x \rceil$ is the smallest integer k such that $x \leq k$

($\lceil x \rceil$ reads the ceiling of x
$\lceil 3.14159 \rceil = 4$)

(VI) Alternative approach:

$$z = \frac{\bar{X} - \mu_0}{\sigma/\sqrt{n}} \Rightarrow z\left(\frac{\sigma}{\sqrt{n}}\right) = \bar{X} - \mu_0$$

$$\Rightarrow (z)(\sigma) = \sqrt{n}(\bar{X} - \mu_0)$$

$$\Rightarrow \frac{(z)(\sigma)}{(\bar{X} - \mu_0)} = \sqrt{n} \Rightarrow n = \left(\frac{(z)(\sigma)}{(\bar{X} - \mu_0)}\right)^2$$

then answer $= \lceil n \rceil$