(2) a) $\bar{X} = 1.47$

b) $S = 0.228$

c) standard err $= \frac{s}{\sqrt{n}} = \frac{0.228}{\sqrt{9}} = 0.0761$

d) $CI = \bar{X} \pm t_{\alpha/2, n-1} \frac{s}{\sqrt{n}}$

$= 1.47 \pm (-1.859) \frac{0.228}{\sqrt{3}}$

$= (1.33, 1.61)$

e) CI s $= \sqrt{\text{CI variance}}$

CI variance $= \left(\frac{(n-1)s^2}{\chi^2_{\alpha/2, n-1}}, \frac{(n-1)s^2}{\chi^2_{1-\alpha/2, n-1}} \right)$

$= \left(\frac{(3-1)0.228^2}{2.73}, \frac{(3-1)0.228^2}{1.50} \right) = (0.0269, 0.153)$

CI $s = \sqrt{\text{CI var}} = \left(\sqrt{0.0269}, \sqrt{0.153} \right) = (0.164, 0.391)$

f) $t = \frac{1.40 - \bar{x}}{s/\sqrt{n}} = \frac{1.40 - 1.47}{0.228/\sqrt{n}} = -0.89$

$P(T < -0.89)$ w/ df $(n-1) = 0.05$

$p = 0.05$

g) $n = \left(2 \cdot z_{\alpha/2} \cdot \frac{s}{M.E}\right)^2$

$= \left(2 \ (-1.64) \ \frac{0.228}{0.03}\right)^2$

$= 627.62$

the sample size would need to be at least 628 plants.

h) $P\left(z < \frac{1.5 - \mu}{\sigma}\right) - P\left(z < \frac{1.3 - \mu}{\sigma}\right)$

$= P\left(z < \frac{1.50 - 1.45}{0.22}\right) - P\left(z < \frac{1.30 - 1.45}{0.22}\right)$

$= \Phi(0.227) - \Phi(-0.682) = 0.590 - 0.248 = 0.342$

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i) $P\left(Z < \frac{1.54 - \mu}{\sigma/\sqrt{n}}\right) - P\left(Z < \frac{1.30 - \mu}{\sigma/\sqrt{n}}\right)$

$= P\left(Z - \frac{1.54 - 1.45}{0.221/\sqrt{4}}\right) - P\left(Z < \frac{1.30 - 1.45}{0.221/\sqrt{4}}\right)$

$= \Phi(0.4545) - \Phi(-1.364)$

$= 0.673 - 0.0863$

$= 0.5891$

Problem 2 Calculations.

```
x <- c(1.40, 1.30, 1.36, 1.38, 1.40, 1.20, 1.52, 1.70, 1.95)
n <- length(x)

# a) sample mean
x_bar <- mean(x)
print(x_bar)

#b) sample stdev
s <- sqrt(var(x))
print(s)

#c) standard error
std_err <- s / sqrt(n)

#d) 90% ci mean
alpha <- 1 - 0.9
t_val <- qt(alpha/2, n-1)
ci <- c(x_bar + t_val * (s/sqrt(n)), x_bar - t_val * (s/sqrt(n)))

#e) 90% ci stdev
chisq1 <- qchisq(alpha/2, n-1)
chisq2 <- qchisq(1 - alpha/2, n-1)
ci_var <- c((n-1)*s^2/chisq1,  (n-1)*s^2/chisq2)
ci_s <- sqrt(ci_var)

#f) proportion < 1.4m
t_val2 <- (1.40 - x_bar) / (s/sqrt(n))
p <- pt(t_val, n-1)

#g)
alpha_g <- 1-0.95
z_g <- qnorm(alpha/2)
n_g <- (2 * z_g * s / 0.03)^2

#h)
mu_h <- 1.45
sigma_h <- 0.22
z_1_50 <- (1.50 - mu_h) / sigma_h
z_1_30 <- (1.30 - mu_h) / sigma_h
p_1_50 <- pnorm(z_1_50)
p_1_30 <- pnorm(z_1_30)
p_h <- p_1_50 - p_1_30

#i)
zi_1_50 <- (1.50 - mu_h) / (sigma_h / sqrt(4))
zi_1_30 <- (1.30 - mu_h) / (sigma_h / sqrt(4))
pi_1_50 <- pnorm(zi_1_50)
pi_1_30 <- pnorm(zi_1_30)
p_i <- pi_1_50 - pi_1_30
```