D. Calculate the 99% confidence interval for the proportion of parts passing inspection.

$\bar{p} \pm z\sigma_{\bar{p}}$

$.90 \pm 2.58(.041)$

$.90 \pm .106$

$.794 \leftrightarrow 1.006$

Proportions over 100% are not possible. Darin needs to lower the point estimate of the sampling distribution's standard deviation with a larger sample.

E. What sample size is necessary to reduce acceptable error to ±5%?

$$n = \bar{p}(1-\bar{p})\left(\frac{Z}{E}\right)^2 = .90(1-.90)\left(\frac{2.58}{.05}\right)^2$$

$$= .90(.10)(2662.56)$$

$$= 239.630 \rightarrow 240$$

II. Darin is also concerned about the weight of page 68 parts. It must be possible for the mean weight of parts to be ≤ 30 mg with a 99% degree of confidence. As indicated on page 68 and reviewed below, a recent test was barely successful. Darin wants to reduce error from the current ±.0279 mg to ±.025 mg. What sample size is required?

Page 68 Problem Review

Given: n = 36, z = 2.58, s = .065 mg and $\bar{x} = 30.025$ mg

$\bar{x} \pm zs_{\bar{x}}$

$30.025 \pm .0279$

29.997 mg ↔ 30.053 mg

Note: This range indicates the population mean estimated from this sample could be under 30 mg.

The finite correction factor is not required because n/N is less than .05.

$$n = \left(\frac{z\sigma}{E}\right)^2$$

$$= \left[\frac{(2.58)(.065)}{.025}\right]^2$$

$$= [6.708]^2$$

$$= 44.997 \rightarrow 45$$

III. Check your answer to problem II by calculating the 99% confidence interval using a sample size of 45 and a sample standard deviation of .065. Analyze the result.

$\bar{x} \pm Z\frac{\sigma}{\sqrt{n}}$

$$\bar{x} \pm 2.58\frac{.065}{\sqrt{45}}$$

$30.025 \pm 2.58(.00969)$

$30.025 \pm .025$

$30.000 \leftrightarrow 30.050$

Note: Error equals 2.58(.00969) = .025

IV. How would the solution to problem III change if the sample of 45 had been taken from a population of 500 items?

$\frac{n}{N} = \frac{45}{500} = .09 > .05$ The finite correction factor should be used.

V. Recalculate the answer to problem III using the finite correction factor.

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}\sqrt{\frac{N-n}{N-1}}$$

$$\bar{x} \pm 2.58\left(\frac{\sigma}{\sqrt{n}}\right)\sqrt{\frac{N-n}{N-1}}$$

$$30.025 \pm 2.58(.00969)\sqrt{\frac{500-45}{500-1}}$$

$30.025 \pm .0239$

$30.0011 \leftrightarrow 30.0489$

Note: As expected, the answer became more exact.