A random sample of 10 miniature Tootsie Rolls was taken from a bag. Each piece was weighed on
a very accurate scale. The results in grams were
3.087 3.131 3.241 3.241 3.270 3.353 3.400 3.411 3.437 3.477
(a) Construct a 90 percent confidence interval for the true mean weight.
Ans.
As standard deviation is calculated from the sample we use t distribution.
90% confidence interval for true mean weight is

$$\overline{x} \pm t_{0.05}\frac{s}{\sqrt{n}} = 3.3048 \pm 1.833\frac{0.131989}{\sqrt{10}} = (3.2283, 3.3813)$$

Where $\overline{x} = 3.3048$ $t_{0.05}$ for 9 df $= 1.833$ $s = 0.131989$ $n = 10$

Confidence interval - mean

90%	confidence level
3.3048	mean
0.131989	std. dev.
10	n
1.833	t (df = 9)
0.0765	half-width
3.3813	upper confidence limit
3.2283	lower confidence limit

(b) What sample size would be necessary to estimate the true weight with an error of ± 0.03 grams with 90 percent confidence?
Ans.

$$\text{Sample size n} = \frac{t_{0.05}^2 s^2}{d^2} = \frac{1.833^2 * 0.131989^2}{0.03^2} = 65.0366 \approx 66$$

Where $t_{0.05}$ for 9 df $= 1.833$ $s = 0.131989$ $d = 0.03$

Thus a sample size of 66 would be necessary to estimate the true weight with an error of ± 0.03 grams with 90 percent confidence.

(c) Discuss the factors which might cause variation in the weight of Tootsie Rolls during
manufacture. (Data are from a project by MBA student Henry Scussel.) **Tootsie**
Ans.
Both chance and assignable factors might cause variation in the weight of Tootsie Rolls during manufacture .

Chance causes are inherent in any particular manufacturing process and it behaves in a random fashion. These variations are beyond the control of Humans and thus cannot be eliminated. These are also called allowable variations.

Assignable causes are non random and thus can be detected and prevented. They are also called preventable variations. Assignable Variation in the weight of Tootsie Rolls during manufacture may be due to defective or substandard raw material , new techniques or operation, negligence of operators, wrong or improper handling of machines, faulty equipment, unskilled or inexperienced technical staff and so on.