# PHYSICS 4211 T. COA

**BEVINGTON 4.2, p72.**

USE A CALCULATOR !
REMEMBER DISTINCTION BETWEEN $\sigma$ & $s$.

FROM DATA:

$\bar{x} = 73.475$
$\Sigma x = 2.939 \times 10^3$
$\Sigma x^2 = 2.253 \times 10^5$
$\boxed{s = 15.52}$
$\sigma = 15.325$
$N = 40$

$$\Rightarrow \bar{x} = 73.5 \pm \frac{15.52}{\sqrt{40}}$$

$$\boxed{\bar{x} = 73.5 \pm \underbrace{2.45}_{\sigma_\mu}}$$

IGNORE "REASONABLENESS" QUESTION.

4.5, P.72. REMEMBER DISTINCTION BETWEEN $s$ & $\sigma$.

(a) $\boxed{\begin{array}{l}\mu = 1.345 \\ s = 1.60 \times 10^{-2}\end{array}}$ $\boxed{\sigma_\mu = \frac{.016}{\sqrt{8}} = 5.66 \times 10^{-3}}$

$\sigma = 1.50 \times 10^{-2}$

(b) $z = \frac{x-\mu}{\sigma}$ $P(|x-\mu| \le 0.02) = A_G(1.25, 0, 1)$

$= \frac{.020}{.016} = 1.25$ $\boxed{P = 0.79}$

by APPENDIX C 2.

BEVINGTON 4.8

$$\mu = \frac{\sum x_i / \sigma_i^2}{\sum 1/\sigma_i^2}$$

$$\boxed{\begin{aligned} \mu &= 0.8940 \times 10^{-10} \text{ sec} \\ \sigma_\mu &= 0.00085 \times 10^{-10} \text{ sec} \\ &= 8.5 \times 10^{-14} \text{ sec} \end{aligned}}$$

BEVINGTON

4.8, p. 73

$$\mu = \frac{\sum x_i/\sigma_i^2}{\sum 1/\sigma_i^2}$$

$$\boxed{\begin{aligned} \mu &= 9.076 \times 10^{-1} \\ \sigma_\mu &= 2.0 \times 10^{-3} \end{aligned}}$$

NOTE NUMBER OF SIGNIFICANT FIGURES.

$\boxed{4.10}$

RECALL, $\sigma_x^2 = \langle x^2 \rangle - \mu^2$. (1)

FOR BOTH DISTRIBUTIONS, $\mu = 100\,\Omega$.

AND

NOW $\langle x^2 \rangle = \int x^2 P_G \, dx$

WHERE $P_G = \frac{1}{\sqrt{2\pi}\sigma} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$.

LET $z = \frac{x-\mu}{\sigma} \Rightarrow dz = dx/\sigma$

$x = z\sigma + \mu$

$x^2 = z^2\sigma^2 + \mu^2 + 2 z\sigma/\mu$

B.4.10

HENCE,

$$\langle x^2 \rangle = \frac{1}{\sqrt{2\pi}} \int_{-z_a}^{z_a} z^2 \sigma^2 e^{-z^2} dz + \frac{1}{\sqrt{2\pi}} \int_{-z_a}^{z_a} \mu^2 e^{-z^2} dz$$

$$+ \frac{2\sigma}{\sqrt{2\pi}} \int_{-z_a}^{z_a} z e^{-z^2} dz \qquad (2)$$

WHERE $\sigma = 20\ \Omega$, $z_a = a/\sigma$

NOW 3RD INTEGRAL $\to 0$ SINCE INTEGRAND ODD.
INTEGRATE 1ST INTEGRAL BY PARTS

$$\int_{-z_a}^{z_a} z^2 e^{-z^2} dz = \underbrace{-\frac{z}{2} e^{-z^2} \Big|_{-z_a}^{z_a}}_{0} + \int_{-z_a}^{z_a} \frac{e^{-z^2}}{2} dz$$

$$\Rightarrow \langle x^2 \rangle = \left( \frac{1}{2} \frac{\sigma^2}{\sqrt{2\pi}} + \frac{\mu^2}{\sqrt{2\pi}} \right) \int_{-z_a}^{z_a} e^{-z^2} dz$$

FOR THE 2ND DISTRIBUTION, $\langle x^2 \rangle = \sigma_5^2 + \mu^2$
w/ $\sigma_5 = 5\ \Omega$

SO,

$$\frac{\sigma_5^2 + \mu^2}{\frac{\sigma_{20}^2}{2\sqrt{2\pi}} + \frac{\mu^2}{\sqrt{2\pi}}} = \int_{-z_a}^{z_a} e^{-z^2} dz.$$

$$= \sqrt{2\pi}\, A_G(z) \qquad (3)$$

$$0.983 = \sqrt{2\pi}\, A_G(z)$$

B. 4.10

$\Rightarrow A_G(z) = 0.39$ $\quad$ w/ $\sigma_s = 5\ \Omega$, $\sigma_{20} = 20\ \Omega$

$\mu = 100\ \Omega$

$\Rightarrow z_a \simeq 0.51$

But $z_a = a/\sigma_{20}$

$\Rightarrow \boxed{a \cong 10\ \Omega}$

So, $r_1 = \mu - a$

$= 100\ \Omega - 10\ \Omega = 90\ \Omega$

$r_2 = \mu + a$

$\simeq 110\ \Omega$

(b) SINCE $A_G(z) = 0.39$

**39 % OF RESISTORS SATISFY CONDITION.**