

ME 1020 Engineering Programming with MATLAB

Problem 7.11:

11.* A shipping pallet holds 10 boxes. Each box holds 300 parts of different types. The part weight is normally distributed with a mean of 1 lb and a standard deviation of 0.2 lb.

- Compute the mean and standard deviation of the pallet weight.
- Compute the probability that the pallet weight will exceed 3015 lb.

Problem setup:

$$\mu_{\text{pallet}} = \mu_{\text{part 1}} + \mu_{\text{part 2}} + \dots = 3000(1.0 \text{ lb}) = 3000 \text{ lb}$$

$$\sigma_{\text{part}} = 0.2 \text{ lb}, \quad \sigma^2 = 0.04 \text{ lb}^2$$

$$\sigma_{\text{pallet}}^2 = \sigma_{\text{part 1}}^2 + \sigma_{\text{part 1}}^2 + \dots = 3000(0.04 \text{ lb}) = 120 \text{ lb}^2$$

$$P(x \leq b) = \frac{1}{2} \left[1 + \operatorname{erf} \left(\frac{b - \mu}{\sigma \sqrt{2}} \right) \right]$$

$$b = 3015 \text{ lb}, \quad \sigma_{\text{pallet}} = \sqrt{120} \text{ lb}, \quad \mu_{\text{pallet}} = 3000 \text{ lb}$$

$$P(x \leq 3015) = \frac{1}{2} \left[1 + \operatorname{erf} \left(\frac{3015 - 3000}{\sqrt{120} \sqrt{2}} \right) \right]$$

$$P(x \geq 3015) = 1 - P(x \leq 3015)$$

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% Problem 7.11
clear
clc
disp('Problem 7.11: Scott Thomas')
mu_part = 1.0;
mu_pallet = 3000*mu_part

sigma_part = 0.2;
variance_part = sigma_part^2;
variance_pallet = 3000*variance_part
sigma_pallet = sqrt(variance_pallet);
b = 3015;

P1 = 0.5*(1 + erf((b - mu_pallet)/(sigma_pallet*sqrt(2))))
P2 = 1 - P1
```

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mu_pallet =

3.0000e+003

variance_pallet =

120.0000e+000

P1 =

914.5482e-003

P2 =

85.4518e-003