P3:

Does there exist a variate X for which

$$\boldsymbol{P[\mu - 2\sigma \leq X \leq \mu + 2\sigma] = 0.6} \quad \text{..... } (1)$$

Solution:

We have

$$P(\mu - 2\sigma \leq X \leq \mu + 2\sigma) = P(|X - \mu| \leq 2\sigma)$$

By Chebychev's inequality $P(|X - \mu| \leq 2\sigma) \geq 1 - \frac{1}{2^2} = 0.75$

Since lower bound for the probability is 0.75, there does not exist a r.v. X for which the equation (1) holds.