Question 1

a) $n = 3 \quad x_1 = 1 \quad x_2 = 6 \quad x_3 = 2$

two-pass algorithm:

$\bar{x} = (x_1 + x_2 + x_3)/n$

$= (1+6+2)/3$

$= 3$

$s^2 = \cancel{}((1-3)^2 + (6-3)^2 + (2-3)^2)/n$

$= (4+9+1)/3$

$= 4.667$

$s = \sqrt{s^2} = 2.1602$

One-pass algorithm:

$\bar{x} = (x_1 + x_2 + x_3)/n = 3$

$s^2 = (\frac{1}{n}\sum_{i=1}^{n} x_i^2) - \bar{x}^2$

$= \frac{1^2 + 6^2 + 2^2}{3} - 3^2$

$= 4.667$

$s = \sqrt{s^2} = 2.1602$

Welford algorithm:

$s = \frac{b-a}{\sqrt{12}} =$

b)

$$x(t) \begin{cases} 3 & 0<t\leq 2 \\ 8 & 2<t\leq 5 \end{cases}$$

$$\bar{x} = \frac{1}{T}\int_0^T x(t)\,dt = \frac{1}{t_n}\sum_{i=1}^{n} x_i \delta_i$$

$$= \frac{1}{5}(3\times 2 + 8\times 3)$$

$$= 6$$

$$s^2 = \frac{1}{T}\int_0^T (x(t)-\bar{x})^2 dt = \frac{1}{t_n}\sum_{i=1}^{n}(x_i-\bar{x})^2\delta_i = \left(\frac{1}{t_n}\sum_{i=1}^{n} x_i^2 \delta_i\right) - \bar{x}^2$$

$$= \left(\frac{1}{5}(3^2\times 2 + 8^2\times 3)\right) - 6^2$$

$$= 6$$

$$s = \sqrt{s^2} = \sqrt{6} = 2.449$$