

W8 - Problem 1

```
In[1]:= data = {5, 5, 4, 4, 7, 4, 3, 7, 6, 4, 2, 5, 6, 4, 5, 3, 5, 4, 2, 6, 7, 2, 4, 5,  
6, 5, 6, 4, 3, 4, 4, 5, 5, 6, 7, 5, 3, 6, 5, 5, 6, 7, 9, 4, 7, 9, 8, 8, 5, 10};
```

```
In[2]:= Mean[data] // N
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Out[2]= 5.22
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In[3]:= Mean[data^2] - Mean[data]^2 // N
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```
Out[3]= 3.1716
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In[4]:=  $\sqrt{\text{Mean}[\text{data}^2] - \text{Mean}[\text{data}]^2}$  // N
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Out[4]= 1.7809
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In[5]:=  $\frac{\sqrt{\text{Mean}[\text{data}^2] - \text{Mean}[\text{data}]^2}}{\sqrt{\text{Length}[\text{data}]}}$  // N
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```
Out[5]= 0.251857
```

W8 - Problem 2

```
In[6]:= ErrEval[A_, x_, x0_,  $\sigma$ _] :=  
A /. Thread[x  $\rightarrow$  x0], Sqrt[Total[(D[A, {x}]^2 /. Thread[x  $\rightarrow$  x0])  $\sigma$ ^2]]];
```

```
In[7]:= ErrEval[T^2, {T}, {298}, {5}]
```

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Out[7]= {88804, 2980}
```

W8 - Problem 3

```
In[8]:= ErrEval[A0 Exp[-k t], {A0, k}, {5.0, 0.19}, {0.2, 0.03}]
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Out[8]= {0.747843, 0.226338}
```

W8 - Problem 4

```
In[9]:= cheese = {29.8, 30.1, 30.5, 30.6, 31.3, 31.7, 32.6, 33.1, 32.7, 32.8};
```

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stiffs = {327, 456, 509, 497, 596, 573, 661, 741, 809, 717};
```

```
In[10]:= Correlation[cheese, stiffs]
```

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Out[10]= 0.947091
```

W8 - Problem 5

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In[11]:= 0.9^20
```

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Out[11]= 0.121577
```

W8 - Problem 6

$$\sigma_{\langle x \rangle} = \sqrt{\text{Var}[\langle x \rangle]} = \sqrt{\text{Var}\left[\frac{1}{N} \sum_{n=1}^N x_n\right]} = \sqrt{\frac{1}{N^2} \sum_{n=1}^N \text{Var}[x_n]} = \sqrt{\frac{N \text{Var}[x]}{N^2}} = \frac{\sigma_x}{\sqrt{N}}$$

W8 - Problem 7

In[12]= **ErrEval**[x + y, {x, y}, {x, y}, {σ_x, σ_y}]

Out[12]= {x + y, $\sqrt{\sigma_x^2 + \sigma_y^2}$ }

In[13]= **ErrEval**[k x, {x}, {x}, {σ_x}]

Out[13]= {k x, $\sqrt{k^2 \sigma_x^2}$ }

In[14]= **ErrEval**[x y, {x, y}, {x, y}, {σ_x, σ_y}]

Out[14]= {x y, $\sqrt{y^2 \sigma_x^2 + x^2 \sigma_y^2}$ }

In[15]= **ErrEval**[x / y, {x, y}, {x, y}, {σ_x, σ_y}]

Out[15]= $\left\{ \frac{x}{y}, \sqrt{\frac{\sigma_x^2}{y^2} + \frac{x^2 \sigma_y^2}{y^4}} \right\}$

In[16]= **ErrEval**[x^k, {x}, {x}, {σ_x}]

Out[16]= {x^k, $\sqrt{k^2 x^{-2+2k} \sigma_x^2}$ }

In[17]= **ErrEval**[k^x, {x}, {x}, {σ_x}]

Out[17]= {k^x, $\sqrt{k^{2x} \text{Log}[k]^2 \sigma_x^2}$ }

In[18]= **ErrEval**[Log[k, x], {x}, {x}, {σ_x}]

Out[18]= $\left\{ \frac{\text{Log}[x]}{\text{Log}[k]}, \sqrt{\frac{\sigma_x^2}{x^2 \text{Log}[k]^2}} \right\}$