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modell aachen  
Interaktive Managementsysteme

between:

$$\begin{aligned} \cdot 1 &= \begin{array}{l} 1,100 \cdot 2^{-4} \\ 1,101 \cdot 2^{-4} \end{array} \begin{array}{l} \leftarrow \\ \text{nearer} \end{array} \end{aligned}$$

$$\begin{array}{l} 1,101 \cdot 2^{-4} \quad \text{No-Bug} \\ 1,101 \cdot 2^{-4} \quad \text{Bug} \end{array}$$

$$\begin{aligned} \cdot 3 &= \begin{array}{l} 1,001 \cdot 2^{-2} \\ 1,010 \cdot 2^{-2} \end{array} \begin{array}{l} \leftarrow \\ \text{nearer} \end{array} \end{aligned}$$

$$\begin{array}{l} 1,010 \cdot 2^{-2} \quad \text{No-Bug} \\ 1,001 \cdot 2^{-2} \quad \text{Bug} \end{array}$$

$$\cdot 5 = 1,000 \cdot 2^{-1}$$

$$\begin{array}{l} 1,000 \cdot 2^{-1} \quad \text{No-Bug} \\ 1,111 \cdot 2^{-2} \quad \text{Bug} \end{array}$$

$$\begin{aligned} \cdot 7 &= \begin{array}{l} 1,011 \cdot 2^{-1} \\ 1,100 \cdot 2^{-1} \end{array} \begin{array}{l} \leftarrow \\ \text{nearer} \end{array} \end{aligned}$$

$$\begin{array}{l} 1,011 \cdot 2^{-1} \quad \text{No-Bug} \\ 1,011 \cdot 2^{-1} \quad \text{Bug} \end{array}$$

$$\begin{aligned} \cdot 9 &= \begin{array}{l} 1,110 \cdot 2^{-1} \\ 1,111 \cdot 2^{-1} \end{array} \begin{array}{l} \leftarrow \\ \text{nearer} \end{array} \end{aligned}$$

$$\begin{array}{l} 1,110 \cdot 2^{-1} \quad \text{No-Bug} \\ 1,111 \cdot 2^{-1} \quad \text{Bug} \end{array}$$



Step 1:  $\sigma_{ST}$

$$\begin{array}{r} .1 + .3: \\ + \quad 1,010 \\ \hline \quad \quad 1101 \\ \hline 1,10101 \end{array} \cdot 2^{-2} \hat{=} 1,101 \cdot 2^{-2}$$

$$\begin{array}{r} (.1 + .3) + .5: \\ + \quad 1,000 \\ \hline \quad \quad 1101 \\ \hline 1,1101 \end{array} \cdot 2^{-1} \hat{=} 1,110 \cdot 2^{-1}$$

$$\begin{array}{r} + .7: \\ + \quad 1,110 \cdot 2^{-1} \\ \hline \quad \quad 1011 \\ \hline 1,1001 \end{array} \hat{=} 1,100 \cdot 2^0$$

$$\begin{array}{r} + .9: \\ + \quad 1,100 \cdot 2^0 \\ \hline \quad \quad 1110 \\ \hline 10,0110 \end{array} \hat{=} 1,001 \cdot 2^1$$

So  $\sigma_{ST} = 2,25$

(Unfortunately the task does not say if the results are truncated or rounded so I assume they are truncated like on slide 4/21.)



Step 2:  $\sigma_{\text{Bug}}$

$$\underbrace{.1 + .3}_{\downarrow} + \begin{array}{r} 1,001 \\ 1101 \\ \hline 1,10001 \end{array} \cdot 2^{-2} \hat{=} 1,100 \cdot 2^{-2}$$

$$\underbrace{\downarrow + .5}_{\downarrow} + \begin{array}{r} 1,111 \\ 1,100 \\ \hline 11,011 \end{array} \cdot 2^{-2} \hat{=} 1,101 \cdot 2^{-1}$$

$$\underbrace{\downarrow + .7}_{\downarrow} + \begin{array}{r} 1,101 \\ 1011 \\ \hline 11,000 \end{array} \cdot 2^{-1} \hat{=} 1,100 \cdot 2^0$$

$$\downarrow + .9 + \begin{array}{r} 1,100 \\ 1111 \\ \hline 100111 \end{array} \cdot 2^0 \hat{=} 1,001 \cdot 2^1$$

So  $\sigma_{\text{Bug}} = 2,25$



### Question A

$$E_{\text{Bug}} = \frac{|\sigma_{\text{Bug}} - \sigma_{\text{ST}}|}{|\sigma_{\text{ST}}|} = \frac{0}{2,25} = 0$$

### Question B

$$E_{\text{ST}} = \frac{|\sigma_{\text{ST}} - \sigma|}{|\sigma|} = \frac{0,25}{2,5} = \frac{1}{10} \quad \text{or} \quad 0,1$$

### Question C

$$u = 1,001 \cdot 2^0 - 1,000 \cdot 2^0 = \frac{1}{1000} \cdot \frac{1}{8}$$

So  ~~$E_{\text{ST}} = 100u$~~

$$E_{\text{ST}} = 0,8u$$