Standard Resistor Values

$$\begin{pmatrix} E6 \\ E12 \\ E24 \\ E48 \\ E96 \\ E192 \end{pmatrix} :=$$

20 %	10 %	5 %	2 %	1 %	0.5 %
E6	E12	E24	E48	E96	E192
1	1	1	1	1	1
1.5	1.2	1.1	1.05	1.02	1.01
2.2	1.5	1.2	1.1	1.05	1.02
3.3	1.8	1.3	1.15	1.07	1.04
4.7	2.2	1.5	1.21	1.1	1.05
6.8	2.7	1.6	1.27	1.13	1.06
	3.3	1.8	1.33	1.15	1.07
	3.9	2	1.4	1.18	1.09
	4.7	2.2	1.47	1.21	1.1

Algorithm

Ratio(ra, A) :=

"Determine optimum resistor pair to make a ratio"

"Reduce Dynamic Range of Value"

$\text{exp} \leftarrow \text{floor}(\log(\text{ra}))$

$\text{mant} \leftarrow \dfrac{\text{ra}}{10^{\text{exp}}}$

"Find Closest Pair By Exhaustion"

$\text{Best} \leftarrow \begin{pmatrix} -1 \\ -1 \end{pmatrix}$

$\text{MinRatioError} \leftarrow 100$

for $i \in 0..1$

  for $k \in 0..\text{rows}(A) - 1$

    for $l \in 0..\text{rows}(A) - 1$

      $\text{temp} \leftarrow \dfrac{A_k \cdot 10^{i}}{A_l}$

      if $\text{Round}(|\text{temp} - \text{mant}|, 0.00000001) < \text{MinRatioError}$

        $\text{MinRatioError} \leftarrow \text{Round}(|\text{temp} - \text{mant}|, 0.00000001)$

        $\text{Best} \leftarrow \begin{pmatrix} k & i \\ l & i \end{pmatrix}$

"Range Correct and Return Result"

return $\begin{bmatrix} A_{(\text{Best}_{0,0})} \cdot 10^{\max(0, \text{exp}) + \text{Best}_{0,1}} \\ A_{(\text{Best}_{1,0})} \cdot 10^{-\min(0, \text{exp})} \end{bmatrix}^{T}$

Test Cases

$TC :=$

Series	Ratio	R1	R2
E12	0.002154	12	5600
E24	0.002154	11	5100
E96	0.002154	9.09	4220
E12	314	470	1.5
E24	314	1600	5.1
E96	314	1070	3.4
E12	3.14159	4.7	1.5
E24	3.14159	16	5.1
E96	3.14159	10.7	3.4
E12	77.777	120	1.5
E24	77.777	300	3.9
E96	77.777	107	1.37
E12	0.333333	3.3	10
E24	0.333333	12	36
E96	0.333333	3.4	10.2
E12	49.23	330	6.8
E24	49.23	330	6.8
E96	49.23	137	2.8
E12	100	100	1
E24	100	100	1
E96	100	100	1
E12	11.23	39	3.3
E24	11.23	18	1.6
E96	11.23	21	1.87
E12	9.979	33	3.9
E24	9.979	15	1.6
E96	9.979	11.3	1.15
E12	6.983	39	5.6
E24	6.983	30	4.3
E96	6.983	41.2	5.9

$r := TC^{\langle 1 \rangle}$

$\zeta :=$
```
"Assign variables"
for i ∈ 0.. 9
    α_(3·i+0) ← E12
    α_(3·i+1) ← E24
    α_(3·i+2) ← E96
α
```

$\theta := \overrightarrow{Ratio(r, \zeta)}$

$\eta :=$
```
"Unravel the array of arrays"
for i ∈ 0.. 29
    B_(i,0) ← (θ_i)_(0,0)
    B_(i,1) ← (θ_i)_(0,1)
B
```

Summary Chart of Test Case Results

Series	Ratio	R1	R2	My R1	My R2
E12	0.002154	12	5600	12	5600
E24	0.002154	11	5100	11	5100
E96	0.002154	9.09	4220	9.09	4220
E12	314	470	1.5	470	1.5
E24	314	1600	5.1	1600	5.1
E96	314	1070	3.4	1070	3.4
E12	3.14159	4.7	1.5	4.7	1.5
E24	3.14159	16	5.1	16	5.1
E96	3.14159	10.7	3.4	10.7	3.4
E12	77.777	120	1.5	120	1.5
E24	77.777	300	3.9	**100**	**1.3**
E96	77.777	107	1.37	107	1.37
E12	0.333333	3.3	10	3.3	10
E24	0.333333	12	36	**10**	**30**
E96	0.333333	3.4	10.2	3.4	10.2
E12	49.23	330	6.8	330	6.8
E24	49.23	330	6.8	330	6.8
E96	49.23	137	2.8	137	2.8
E12	100	100	1	100	1
E24	100	100	1	100	1
E96	100	100	1	100	1
E12	11.23	39	3.3	39	3.3
E24	11.23	18	1.6	18	1.6
E96	11.23	21	1.87	21	1.87
E12	9.979	33	3.9	**10**	**1**
E24	9.979	15	1.6	**10**	**1**
E96	9.979	11.3	1.15	**10**	**1**
E12	6.983	39	5.6	39	5.6
E24	6.983	30	4.3	30	4.3
E96	6.983	41.2	5.9	41.2	5.9