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$$r_{AB} = r + \frac{r \cdot r_n}{r + r_n}$$

Since the network is infinite, we can disregard the addition of one section of each sequence. This allows to determine the resistance between points A and B as equal to the resistance between C and D.

Consequently,

$$r_n = r + \frac{r \cdot r_n}{r + r_n} \quad .$$

After solving this equation, we have

$$r_n = r \cdot \frac{1 + \sqrt{5}}{2} = r \cdot \phi \quad ,$$

where ϕ is the Golden Ratio.

See also, S. L. Basin, "The Fibonacci Sequence as it Appears in Nature," Fibonacci Quarterly, Vol. 1, No. 1, p. 53.

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Editorial Note: The question remains how the students are to find the Fibonacci or Lucas representation for the first factor. To find the Fibonacci representation for 28, we subtract the largest Fibonacci number not exceeding 28, namely 21. This leaves 28 - 21 = 7; so our next choice is 5; 28 - 21 - 5 = 2, a Fibonacci number. Thus, 28 = 21 + 5 + 2. This will always yield the representation with the least number of summands.

REFERENCES

1. V. E. Hoggatt, Jr., Fibonacci and Lucas Numbers, Houghton-Mifflin Company, Boston (1969), pp. 69-72.
2. John L. Brown, Jr., "Note on Complete Sequence of Integers," American Mathematical Monthly, Vol. 67 (1960), pp. 557-560.