

Additivity twice: a convolution emerges

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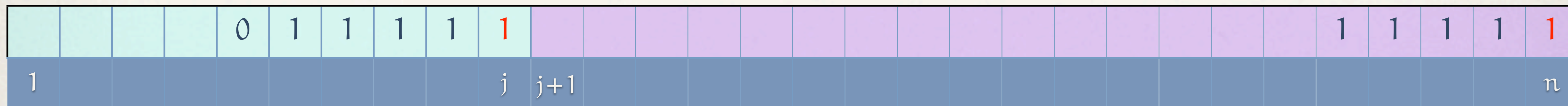
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Key observation: a success run will occur *at* trial n if, and only if, there is a *first* success run occurring at *some* trial j at or before n .

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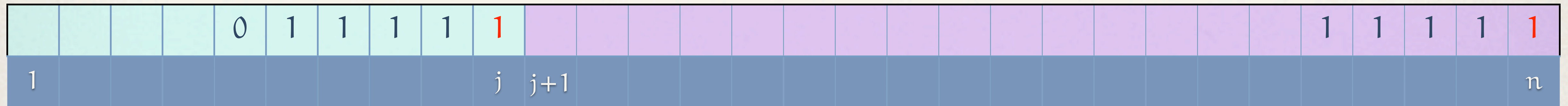


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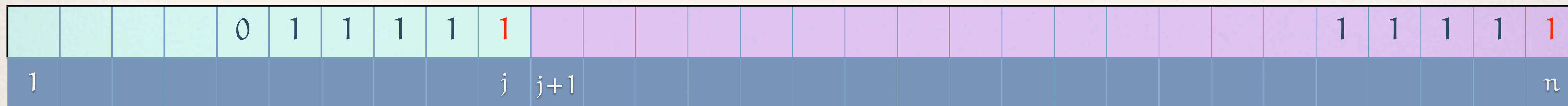
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Renewal at j followed by a success run terminating at the $(n - j)$ th trial after restart:
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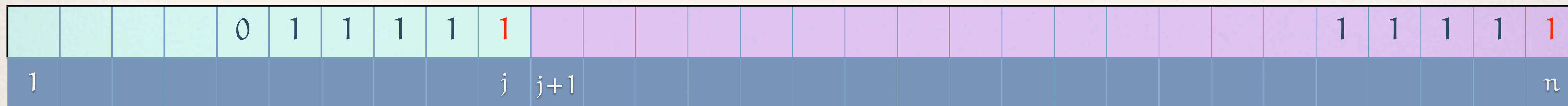
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Independence: the probability of the sequence is $f_j \cdot u_{n-j}$.

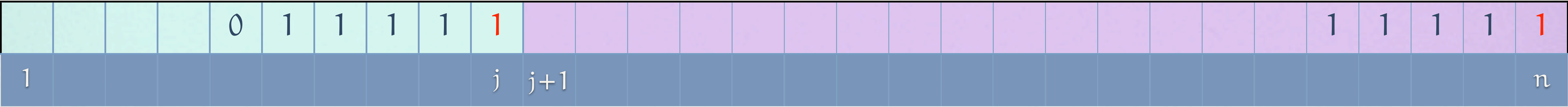
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Additivity! $u_n = f_1 u_{n-1} + f_2 u_{n-2} + \cdots + f_j u_{n-j} + \cdots + f_{n-1} u_1 + f_n$

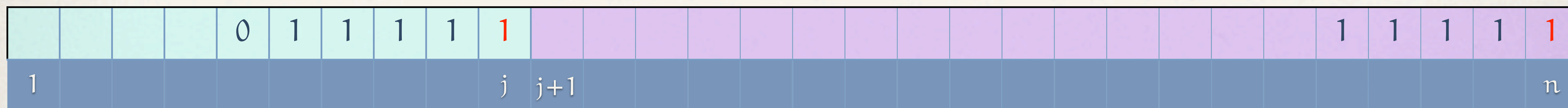
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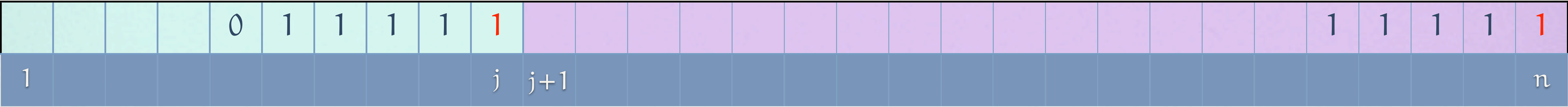
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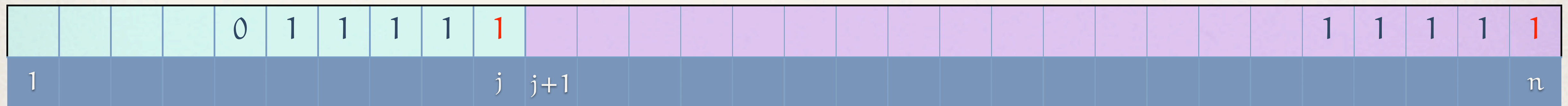
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$$f_n = u_n - f_1 u_{n-1} - f_2 u_{n-2} - \cdots - f_j u_{n-j} - \cdots - f_{n-1} u_1$$

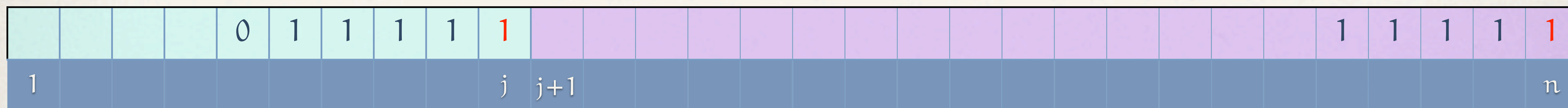
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Slogan: If you know u_1, u_2, \dots, u_n and f_1, f_2, \dots, f_{n-1} then you know f_n .