The **Kaplan–Meier estimator** (KM curve) is a **non-parametric statistic** used to estimate the **survival function** from **time-to-event data**.
It's widely used in **medical research** to analyze how long patients survive after treatment or diagnosis — even when not all patients have had the event (like death or relapse) yet.

Term	Meaning
Event	The outcome of interest (death, relapse, recovery).
Survival Time (t)	Time from start (diagnosis/treatment) until event or last follow-up.
Censoring	When a patient's follow-up ends before the event happens (e.g., still alive when the study ends).
Survival Probability S(t)	The probability that a patient survives beyond time *t*.

The Kaplan–Meier estimator is given by:

$$S(t) = \prod_{t_i \leq t} \left(1 - \frac{d_i}{n_i}\right)$$

where:

- t_i = time of event i
- d_i = number of events (e.g., deaths) at time t_i
- n_i = number of patients "at risk" just before t_i

Let's say we track **5 patients** after a **cancer diagnosis**, and we record how long they lived (in months) after treatment.
Step 1: Order by time of event

Patient	Time (months)	Event (Death=1, Censored=0)
P1	6	1
P2	8	1
P3	10	0
P4	12	1
P5	15	0

Event time (months)	No. at risk (n_i)	No. of events (d_i)	Survival Probability step
6	5	1	$1 - \frac{1}{5} = 0.8$
8	4	1	$1 - \frac{1}{4} = 0.75$
12	2	1	$1 - \frac{1}{2} = 0.5$

(*P3 and P5 are censored at 10 and 15, so they don't count as events.*)

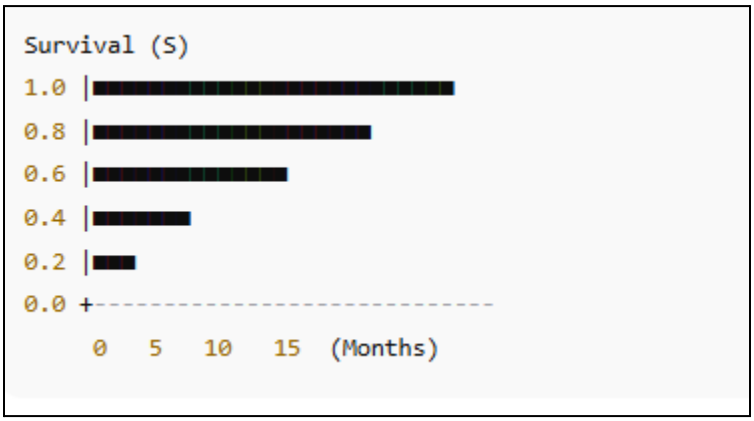
Step 2: Multiply cumulative probabilities

$$S(6) = 0.8$$

$$S(8) = 0.8 \times 0.75 = 0.6$$

$$S(12) = 0.6 \times 0.5 = 0.3$$

Time (months)	Survival Probability S(t)	Meaning
6	0.8	80% of patients alive at 6 months
8	0.6	60% of patients alive at 8 months
12	0.3	30% of patients alive at 12 months



Kaplan–Meier analysis helps answer:

- What percentage of patients survive past a certain time?
- What is the **median survival time**?
- Compare survival curves of **different treatments or patient groups** using a **log-rank test**.