SOFTWARE ENGINEERING

PART A

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PART-A

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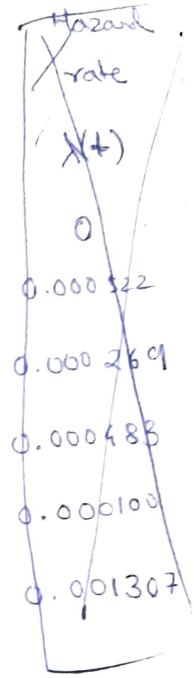
Time	Number of failures	Cumulative failures	No. of Survivors	Reliability	Cumulative Failure Distribution	Failure density Function	Hazard rate
t	f	$N_f(t)$	$N_s(t)$	R(t)	F(t)	f(t)	λ(t)
0	0	0	172	1	0	0	0
1000	59	59	113	0.657	0.343	0.000343	0.000522
2000	24	83	89	0.517	0.482	0.000139	0.000269
3000	29	112	60	0.349	0.651	0.000169	0.000488
4000	30	142	30	0.174	0.825	0.000174	0.000100
5000	17	159	13	0.075	0.924	0.000099	0.001307
6000	13	172	0	0	1	0.000075	



ⓘ Calculation of Reliability R(t) :-

$$R(t) = \frac{N_s(t)}{N_0}$$

where N_0 = the size of the sample that we start with and $N_s(t)$ is the number of survivors.

Ex - $R(1000) = \frac{N_s(1000)}{N_0} = \frac{113}{172} = 0.657$

ⓘ Calculation of cumulative failure distribution F(t) :-

$$F(t) = \frac{N_f(t)}{N_0}$$

where $N_f(t)$ denotes the no. of components that have failed by time t.

Ex - $F(1000) = \frac{N_f(1000)}{N_0}$ =

ⓘ Calculation of failure density function f(t) :-

$$f(t) = \frac{d}{dt}(N_f(t))/N_0$$

$$= \lim_{\Delta t \to 0} \frac{N_f(t+\Delta t) - N_f(t)}{N_0 \Delta t}$$

$$\Rightarrow f(t) = \frac{N_f(t+\Delta t) - N_f(t)}{N_0 \Delta t} \quad \text{where } \Delta t = 1000$$

$$= \frac{N_f(t+1000) - N_f(t)}{N_0 \times 1000} \qquad N_0 = 172.$$

● Calculation of Hazard rate $\lambda(t)$:-

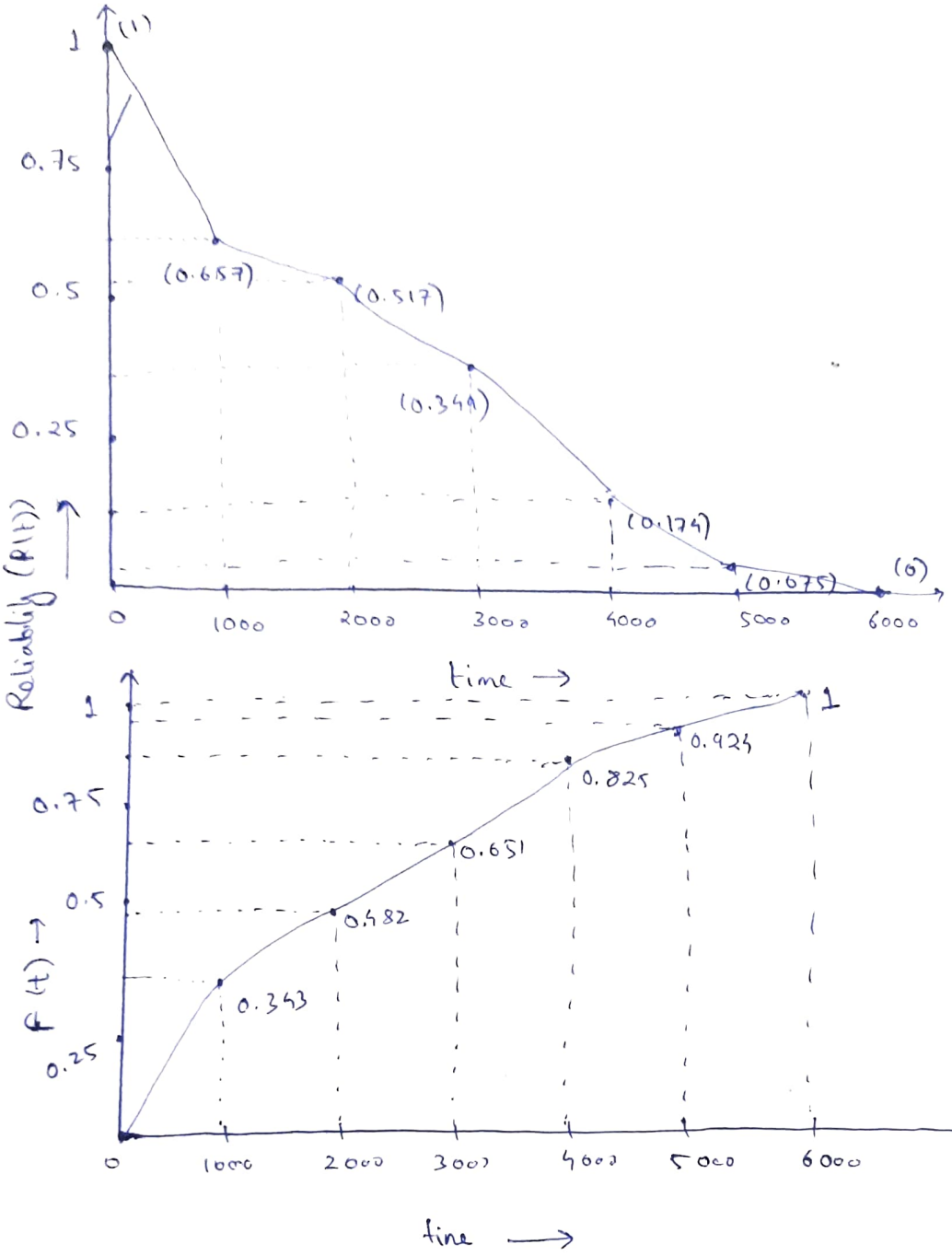
$$\lambda(t) = \frac{d}{dt}(N_f(t)) / N_s(t)$$

$$= \lim_{\Delta t \to 0} \frac{N_f(t+\Delta t) - N_f(t)}{N_s(t)\,\Delta t}$$

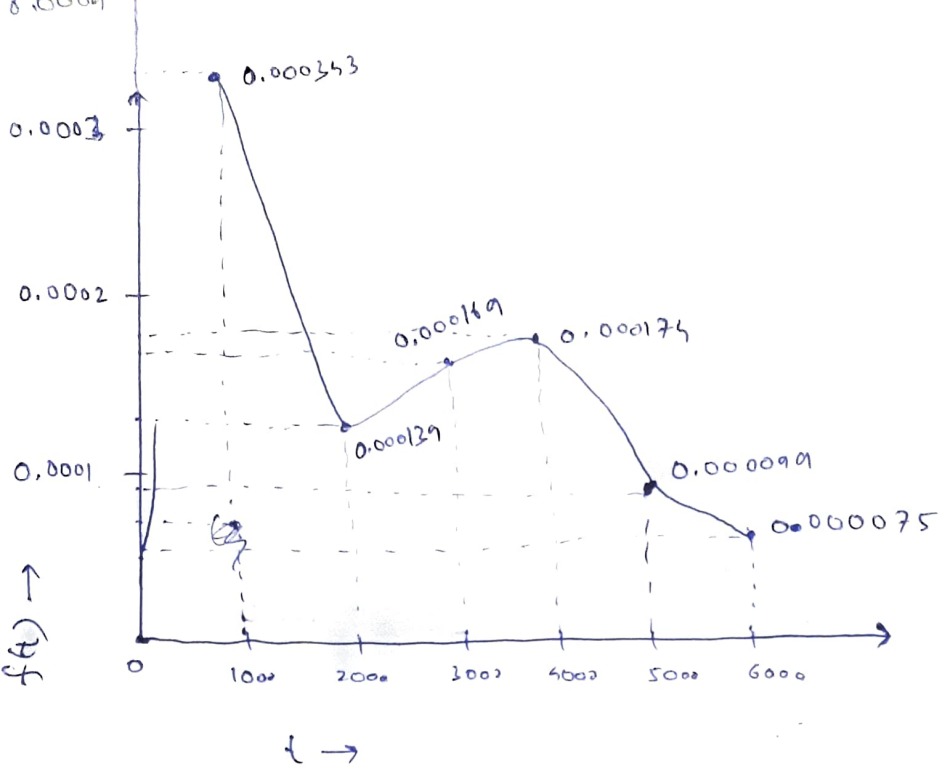
$$\approx \frac{N_f(t+\Delta t) - N_f(t)}{N_s(t)\,\Delta t} \quad \text{where } \Delta t = 1000$$

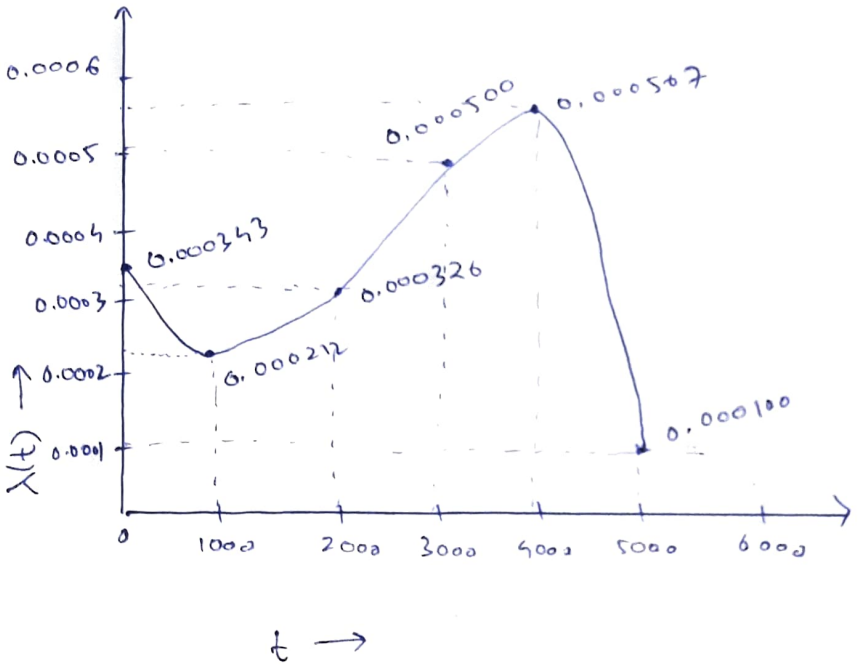
$$= \frac{N_f(t+1000) - N_f(t)}{N_s(t) \times 1000}$$

Time t	Hazard rate $\lambda(t)$
0	0.000343
1000	0.000212
2000	0.000326
3000	0.000500
4000	0.000567
5000	0.000100
6000	-


1
0.75
0.5
0.25
(1)
(0.657)
(0.517)
(0.349)
(0.174)
(0.075)
(0)
0
1000
2000
3000
4000
5000
6000
Reliability (R(t))
time →

1
0.75
0.5
0.25
0.343
0.482
0.651
0.825
0.924
1
0
1000
2000
3000
4000
5000
6000
F(t) →
time →


0.000343
0.0003
0.0002
0.0001
0.000169
0.000174
0.000129
0.000099
0.000075
f(t)
0
1000
2000
3000
4000
5000
6000
t


0.0006
0.0005
0.0004
0.0003
0.0002
0.0001
0.000343
0.000272
0.000326
0.000500
0.000507
0.000100
λ(t)
0
1000
2000
3000
4000
5000
6000
t