sprint 4 - deliverables
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① yet more lightbulbs

lightbulb rated for 20000 hrs, $\lambda = 1/20000$

P(two lightbulbs last over 30000 hrs)

CCDF - $\bar{F}_x(x) = P(X > 30000)^2 = (e^{-\lambda(30000)})^2$

$= .0497870683$

② the non-persistence of memory

$\lambda = 1/20000$, $X_1 = 30000 - 10000 = 20000$, $X_2 = 30000 - 25000 = 5000$

P(both lightbulbs last over 30000 hrs), X_1 and X_2 via memoryless prop

CCDF - $\bar{F}_x(x) = P(X > 20000) * P(X > 5000) = (e^{-\lambda(20000)})(e^{-\lambda(5000)})$

$= .2865047969$

③ check my math

$\bar{S} = .005$ sec, $\bar{R} = 1$ sec, $\bar{N} = 120$ jobs, # disk accesses per job = 2

Little's law: $\bar{N} = \Lambda \bar{R} \rightarrow (120 \text{ jobs}) = \Lambda (1 \text{ sec}) \rightarrow \Lambda = 120$ jobs/sec

$\lambda = 120$ jobs/sec (via conservation law: $\lambda = \Lambda$)

utilization $= \lambda \bar{S} = (120 \text{ jobs/sec})(.005 \text{ sec})(2)$

$= 1.2$

(*) utilization is a dimensionless value with a range $[0, 1)$
getting a utilization value over one suggests there are problems with the measured values.

④ unbalanced server loads

$\upsilon = \lambda \bar{S}$

60% arrivals — (A) $\upsilon = .8$, $\bar{S} = ?$

40% arrivals — (B) $\upsilon = .6$, $\bar{S} = 250 \mu s$

$\lambda = \upsilon_B / (\text{arrivals}_B * \bar{S}_B)$

$\lambda = (.6)/((.4)*(250))$

$\lambda = .006$

$\bar{S}_A = \upsilon_A / (\text{arrivals}_A * \lambda)$

$\bar{S}_A = (.8)/((.6)*(.006))$ $\bar{S}_A = 222.\overline{2} \mu s$

⑤ the m/m/1 queue

average residence time $= 3.25$ * full chart in README.md