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Bus 273: Statistical Analysis for Business

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PROBLEM SHEET # 10

Problem 1: The lifetime of an electric bulb is an exponentially distributed random variable with mean 2500 hours.

a) What is the probability that a typical light bulb will burn for at least 3000 hours?

b) A light installation has 10 bulbs. What is the probability that *all* of them will last for at least 3000 hours?

Problem 2: A project involves four activities A_1, A_2, A_3, A_4. Activity A_i must be completed before activity A_{i+1} can be started ($i = 1, 2, 3$). Let X_i be the duration of activity A_i, that is, the time needed to complete activity A_i. Optimal, most likely, and pessimistic durations (in days) are given in the table below. We assume that durations are independent.

	duration X_i		
activity	optimal	most likely	pessimistic
A_1	2	4	6
A_2	4	5	7
A_3	4	6	10
A_4	3	4	8

The completion time of the entire project is then given by the random variable $X = \sum_{i=1}^{4} X_i$. — Use the approximate expressions for expectation and variance of the beta distribution to solve the following problems.

a) Compute the expected duration of each activity.

b) Compute the variance of each duration.

c) Compute the expected project time, $\mathrm{E}(X)$.

d) Compute the standard deviation of the project time, $\mathrm{sd}(X)$.

e) Which statement about X can be made using the one-sigma-interval?

f) Now suppose it took five days to complete A_1. What is the expected remaining time to completion of the entire project?

g) It turned out that the entire project took 25 days to complete. In view of your results in (c), (d), (e): Would you say this completion time is very long, or very short, or is it just "normal"?

h) Find an example of activities A_1, A_2 whose durations X_1, X_2 might not be independent. How would this dependence affect expectation and variance of $X_1 + X_2$?