Exam assignment for Computer Systems Modelling and Semantic Web course

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1 Problem statement

1.1 Question 1

A three tier web application is composed by a web server WS, an application server AS and a database server DB: services are called in sequence. Three types of requests populate the system: N_U user requests (characterised by a think time Z_U), N_S remote procedure call software agents, and N_B batch elaboration programs. Each type of request requires a different amount of time from each resource, according to an exponential distribution, with average service times shown in the following table:

	U	S	B
S_{WS}	80 ms	15 ms	5 ms
S_{AS}	30 ms	25 ms	120 ms
S_{DB}	20 ms	50 ms	40 ms

Without using the simulator, compute all class-oriented and overall performance indices for the system (you may write a Python program for the task and document it in your report, if you like). Verify the results by using the simulator and describe your approach, documenting the process. Which server is the most busy one?

1.2 Question 2

In order to match specifications, each server is replicated respectively in C_{WS}, C_{AS} and C_{DB} instances, each one running on a different machine that shares a common queue of finite capacity K_{WS}, K_{AS} and K_{DB}.

Requests arriving at a full station are blocked after they are served.

We want to determine the minimum number of replicas C_{WS}, C_{AS} and C_{DB} for each server such that requests are served on the average in less than 2 s, by using the simulator.

Each group will be assigned a different set of the missing parameters.