Performance modelling of a local versioning service.

A small AI software company, where *N = 15* developers work, uses a local versioning service to store and sync the source code. The system has a local cache, to speed up the process. If we have a cache hit, the request terminates immediately. If we have a cache miss, the data is sent to a storage controller that first access the data on one of its local disks, then it replicates the request on a cloud based remote file system. The local storage system has three disks that have been purchased in different times: each one is then characterized by a different average service time, and fraction of file access. Since the source code is very small, the queue at the network interface when replicating the files on the cloud is negligible, and the remote file system can be modeled with a delay station. The collected parameters are the following:

Think time of the users	3 minutes per request
Service time of the versioning system	2 second per request
Hit ratio of the cache	75%
Service time of the storage controller	0.5 second per request
Service time of Disk 1	1.5 second per request
Service time of Disk 2	1.0 second per request
Service time of Disk 3	0.5 second per request
Service time of the cloud storage	5 second per request
Percentage of files on Disk 1	18%
Percentage of files on Disk 2	32%
Percentage of files on Disk 3	50%

Due to the popularity of IA, the company is experiencing an incredible growth, and it is expected to raise its number of employers up to *N = 150* in the near future. Using a *JSimGraph* model, perform the following performance studies.

Questions:

1. Add a Picture of your queueing network model.
2. Add a plot of the average time each request will take, varying the number of users from the current configuration (*N = 15*) to the expected configuration (*N = 150*), at a step of $\Delta N = 15$ (i.e. consider *N = 15, 30, 45, … , 135, 150*). Please remember that we must not consider the think time: we cannot use the plot computed by JMT directly! We should copy the value in a tool like Excel, and manually remove the think time from each simulation, and plot the resulting curve/
3. What will happen if we add a new disk with a service time of 0.4 second per request, and share on it half of the requests that are currently routed to the most utilized disk? Modify the queueing network accordingly.
4. Add a Picture of the modified queueing network.
5. Add a plot of the average time each request will take in this new configuration, varying the number of users from the current configuration (*N = 15*) to the expected configuration (*N = 150*), at a step of $\Delta N = 15$. As before, manually remove the think time from the system response time to have an unbiased answer.

Please enter the answers, together with a ZIP file containing the .jsimg files of your two models and the Excel (or whatever you used) file in which the two plots were created, renamed with PPTX extension, in the following form:

https://forms.office.com/Pages/ResponsePage.aspx?id=K3EXCvNtXUKAjjCd8ope67-7CBR7gDJEgHF_krAEqPhUNjhKUzg3NlNDVTQxUTRKTzFPNTBJM0RENS4u

The deadline is **Midnight, 2/10/2025**