# Performance modelling of a car maintenance facility.

Let us consider car maintenance facility. The maintenance process consists of three phases: first the cars are registered at the check-in, then the actual service takes place, and finally an inspection is performed before the vehicle is returned to the customer. The facility has one employee at the check-in, three technicians at the service, and two workers at the inspection. Each phase has a small parking area, where cars can wait before being served.
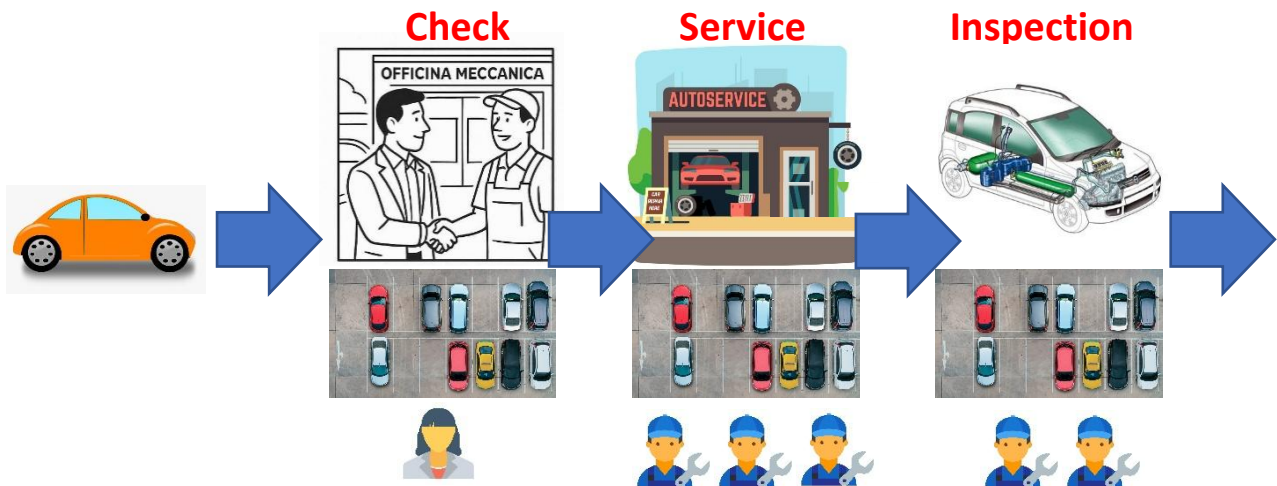
Both the service and the inspection phases can be considered as multiple server queues, and all the stations work in *First-Come-First-Served* order. The durations of all the phases are the following:

Inter-arrival time distribution	Hyper-exponential with: λ_1 = 6 cars per hour λ_2 = 0.9 cars per hour p_1 = 0.2 *(to convert from cars per hour to cars per minute, divide the rates by 60)*
Check-in	Exponential, with 20 minutes average
Service	Exponential, with 90 minutes average
Inspection	Exponential, with 56 minutes average

Currently, the parking for the check-in can hold 4 cars, the one for service can hold 6 cars, and the one for the inspection 5 cars. Cars arriving at the checking are not accepted (dropped) if the parking is full. If the park is full at either the service or inspection facilities, the previous stations are blocked with the BAS discipline.

Questions:

1. Compute the average response time of the system
2. Compute the drop rate of the system
3. After rearranging the space, two additional parking slots can be obtained. To which phases it would be better to allocate these slots to reduce the drop-rate (i.e. the check-in, the service or the inspection)?
4. Compute the average response time of the system in the new configuration.
5. Compute the drop rate of the system in the new configuration.

Please enter the answers, together with a ZIP file containing the .jsimg files of your models (original, and optimized with two extra parking slots), renamed with PPTX extension, in the following form:

https://forms.office.com/Pages/ResponsePage.aspx?id=K3EXCvNtXUKAjjCd8ope67-7CBR7gDJEgHF_krAEqPhUMVpXVU1BMVRBSUhENEU1M0MxVzRIVjBXTC4u

The deadline is **Midnight, 17/10/2025**