Performance modelling of the back-end of a small insurance company

A small insurance company, has a total of 50 employers, which can work on two possible tasks: issue and propose new policies (Task A), or check claims and refunds (Task B). The back-end is composed by two application servers: one (Server A) mainly used for Task A, and the other (Server B) mainly used for Task B. A little access to the other server, however, is needed to interconnect policies and claims.

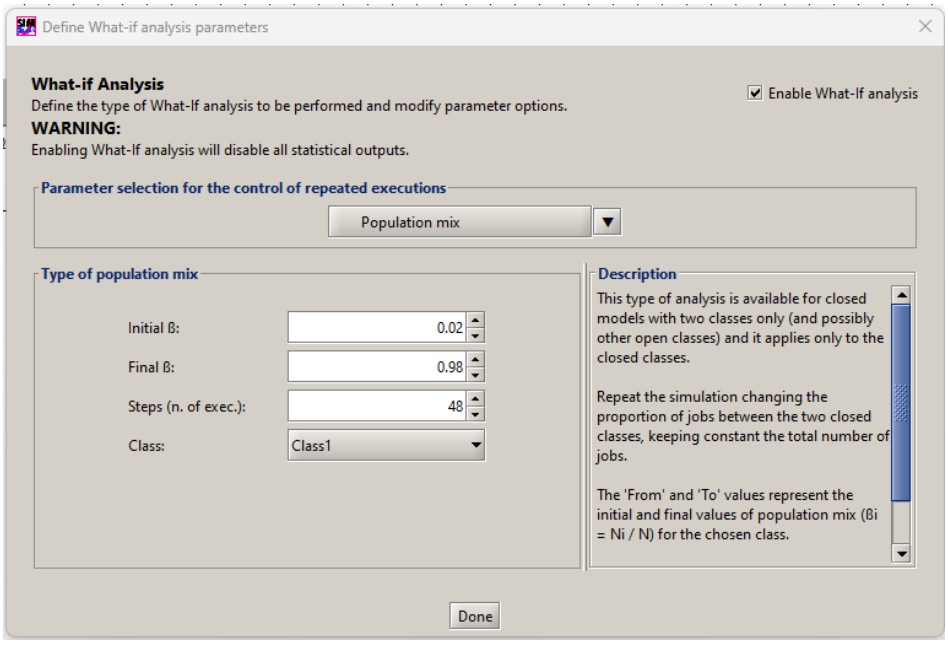
Each day, the company assigns part of its 50 employers to either Task A or Task B, depending on the specific need. The computing infrastructure is composed by 4 Virtual Machines (VM) running in the cloud. One is always assigned for Server A, one for Server B, and the other can be flexibly assigned to either tasks, to reduce the system response time. When a task has more than one VM assigned to it, can be considered as a *multiple server*. To simplify the model, queues can be considered of *infinite capacity*, and serving jobs in *First-Come-First-Served*. Moreover, since every task uses both types of servers, even if with different requirements, the system can be considered as *a tandem closed network*.

The duration of the various actions, are the following.

Think time of the users	Exponential with an average of 1 s.
Task A on Server A	Exponential with an average of 8 s.
Task B on Server A	Exponential with an average of 1 s.
Task A on Server B	Exponential with an average of 1 s.
Task B on Server B	Exponential with an average of 10 s.

Questions:

1. Consider the three possible VM allocations: 1A 3B (one for Task A, and three for Task B), 2A 2B and 3A 1 B, for all the possible employers' allocations (from 1 doing Task A and 49 doing Task B, to 49 doing Task A and 1 doing Task B). Plot (in a single graph) the average response time as function of the arrival rate. Use Excel or another graphing software to superpose the values computed by JMT. Hint: JMT has a special What-if analysis called "population mix", which allows to test different distribution of jobs among the classes, with a given total amount. In particular, you can copy the setting shown in the figure below:



2. Which is the minimum number of Task A employers for which scenario 3A 1B is the best?
3. Which is the maximum number of Task A employers for which scenario 1A 3B is the best?
4. Comment the results

Please enter the answers, together with a ZIP file containing the .jsimg files of your model, renamed with PPTX extension, in the following form:

https://forms.office.com/Pages/ResponsePage.aspx?id=K3EXCvNtXUKAjjCd8ope67-7CBR7gDJEgHF_krAEqPhUMklUTlA4WjZRQ1BYQVk0MTFWMVQ4U0NUWC4u

The deadline is **Midnight, 24/10/2025**