

OPERATIONS MANAGEMENT EXAM

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Queue theory exercise

The “Jurassic Park” themed comic store welcomes 200 passionate fans daily.

The first stage when entering the store is the registration room, where they reserve the comic book they want to read, take the code of the book location according to the superhero section. In this stage, a single operator named Anna serves the clients, one by one, by indicating where to take the book from and registering client data and reserved book. 8% of registrations done by Anna are second registration because some fans realize that they need some extra books and so they go back and reserve again.

After the registration room, the fans go to stage 2 called the “science room” where they usually read. Here, Jack and Julie help them according to a single FIFO queue. After this stage, 15% of two-times registered fans and 5 % of one-time registered fans go home directly, while all the remaining go to the following step of the process, the video game section. In this section, Robert and Milly serve them, each of them serves her/his queue.

The comic store is open 8 hours per day.

In the table below, the values of the service rate of the different resources are reported. For these resources, we can assume the arrival and the service rates follow a negative exponential distribution.

Process	Service rate (1 resource)
Stage 1: Registration Room	240 people/day
Stage 2: String Theory Room	150 people/day
Stage 3: Star Trek	120 people/day

Question 1) (2 points) You are given four queueing model systems, only one of them is the right one. Indicate the right queuing model system in the excel sheet given to you.

Question 2) (3 points) Having chosen the model, please fill in the table with all the relevant parameters for each stage (Arrival rate (pieces/day), Service rate, Type of queue, W_s (in minutes), ρ).

Approximate values are acceptable, no need for interpolation

Question 3) (4 points) Calculate the expected throughput time for each path as well as the expected throughput time of the system considering the clients passing through all stages.