

37. McAuto, a fast food restaurant, has a window where it receives orders from cars. The arrivals of customers follow a Poisson probability distribution, and the mean arrival rate is 10 cars per hour. Service times follow an exponential probability distribution with a mean service rate of 12 cars per hour.
- What is the probability of there being no customer waiting in the system?
 - If you arrive at the restaurant, how many cars do you expect to see waiting and being served?
 - What is the probability of a least one car waiting?
 - What is the average time to wait in a queue to be attended to?
 - As a potential customer of this system, would you be satisfied with the system? Why?
38. Jobs arrive at a processing centre in accordance with a Poisson process at a mean rate of two/day, and the operation time has an average exponential distribution of 0.25 days. This centre has enough space for the material to be processed to take on three jobs besides that it is already processing. Additional works are kept temporarily in a less convenient place. What proportion of time is suitable for the space that the processing centre has to keep all the jobs that arrive?
39. The supervisor at the Precision Machine Shop wants to determine the staffing policy that minimizes total operating costs. The average arrival rate at the tool crib, where tools are dispensed to the workers, is eight machinists per hour. Each machinist's pay is \$20 per hour. The supervisor can staff the crib either with a junior attendant who is paid \$5 per hour and can process 10 arrivals per hour or with a senior attendant who is paid \$12 per hour and can process 16 arrivals per hour. Which attendant should be selected, and what would be the total estimated hourly cost?
40. Das Mega Multiplex Kino betreibt 3 Kinokassen um Tickets an die Kinobesucher zu verkaufen. Die Bedienzeit für einen Kunden variiert aufgrund der Anzahl der gekauften Tickets, Sonderwünsche für Plätze etc. kann aber exponential verteilt mit Mittelwert 2 min angenommen werden. Die Kinobesucher stellen sich in einer Schlange für alle 3 Kassen an und werden nach einer FCFS (First Come First Served) Regel bedient. Im Durchschnitt werden 81 Kinobesucher pro Stunde erwartet (Poisson verteilt). Die Vorschau beträgt 10 Minuten; darum soll auch die Dauer der Beschaffung von Tickets im Durchschnitt nicht länger als 10 Minuten sein. Wie lange dauert nun wirklich durchschnittlich der Kauf einer Kinokarte?
41. The calculation centre in Inland Revenue's premises in Nice is equipped with four identical central computers which process the jobs. There are 25 users connected from their own PC at any given time. Each user is capable of processing one jobs via his/her PC every 15 min, on average, but the real time between sending jobs is exponential. The jobs that arrive automatically reach 2 min. Calculate the following:
- The percentage of time that the entire calculating centre is not operating
 - The average number of jobs waiting to be executed
 - The probability that one job is not immediately executed in the central computer
 - The average time before one job is returned to the user
 - The average number of central computers not in use.

42. A year five Wirtschaftsmathematik student studying at TU Wien does some temporary substitute work on the banking sector every 30 days on average, and this time follows an exponential distribution. After acquiring one of these works, its duration is also aleatoric, exponentially distributed and its mean duration is 60 days.

The money earned depends on the total number of days worked in each contract, paid at \$100 daily. For unemployment periods, the student has taken out an insurance for which \$50 is paid for each day on the dole.

Build a queuing model to establish the mean annual income (1 year = 365 days) that the student earns. (Hint: single server, finite customer population of 1.)