

In []:

```
#
#   Example 1: Evaluation of single server queueing system parameters
#
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#
# =====
#           Single Server Queueing System (ssqs)
#
#           +-----+
#   Arrival |         Server         |   Output
#           |   Queue   +-----+   |
#   arrival_rate | -----+ |         | |
#   ----->| | | | | | service_rate | | ----->
#           | -----+ |         | |
#           |         +-----+   |
#           +-----+
#
# System notation (A/B/1):
# A - distribution of inter-arrival time
# B - distribution of service time is determined
# 1 - single server
#
# Distribution types:
# M - exponential,
# D - determined (fixed),
# G - general (time variance must be provided))
# =====

from qsystems import ssqs

# -----
# System initial parameters:
# -----

system_notation = "M/D/1"
# Arrival parameters
arrival_rate = 80 # [entities/t.u.], for example [users/hour]
# Server parameters
service_rate = 100 # [entities/t.u.]
# Note: For stable system arrival_rate must be < service_rate
# -----

# -----
sys_params = ssqs(qs=system_notation, ar=arrival_rate, sr=service_rate)

print("System %s parameters:"%sys_params['qs'])
print(" - Arrival rate:",round(sys_params['ar'],10))
print(" - Service rate:",sys_params['sr'])
print(" - Mean inter-arrival time:",sys_params['a'])
print(" - Variance of inter-arrival time:",round(sys_params['va'],10))
print(" - Mean service time:",sys_params['s'])
print(" - Variance of service time:",sys_params['vs'])
print(" - Server utilization (load):",sys_params['u'])
print(" - Mean number of entities in queue:",sys_params['lq'])
print(" - Mean number of entities in system:",sys_params['l'])
print(" - Mean waiting time in queue:",sys_params['wq'])
print(" - Mean waiting time (total time) in system:",sys_params['w'])
```

System M/D/1 parameters:

- Arrival rate: 80.0
- Service rate: 100.0
- Mean inter-arrival time: 0.0125
- Variance of inter-arrival time: 0.00015625
- Mean service time: 0.01
- Variance of service time: 0
- Server utilization (load): 0.8
- Mean number of entities in queue: 1.6
- Mean number of entities in system: 2.4
- Mean waiting time in queue: 0.02
- Mean waiting time (total time) in system: 0.03