

Loading of containers

Let us consider a crane loading containers on a ship. The containers are transported from the storage area to the crane by special trucks, the so-called slaves. These slaves arrive according to a Poisson stream with rate λ slaves per minute. The service time at the crane consists of two phases: the cranes fetches the container from the slave, and then loads it on the ship. The time (in minutes) to fetch a container is denoted by B_1 , and to load it on the ship by B_2 . A slave, of course, does not have to wait for the second phase, but immediately after the first phase (fetching) it can return to the storage area to get the next container.

- (i) For which values of the parameters λ , $E(B_1)$ and $E(B_2)$ is the system stable?

Assume that, on average, 4 slaves per hour arrive at the crane. The time to fetch a container is on average 3 minutes with a standard deviation of 2 minutes; the time to load a container is on average 10 minutes with a standard deviation of 8 minutes.

- (ii) Determine the mean waiting time and the mean sojourn time of a slave.

Let us now consider a crane at the storage area. The slaves arrive again according to a Poisson stream with rate λ slaves per minute, and the service time at the crane consists of two phases: the crane first fetches a container from the storage area, and then loads it on the slave (after which the slave immediately leaves to the crane loading the ship). The time (in minutes) to fetch a container is denoted by C_1 , and to load it on the slave by C_2 . For fetching a container from the storage area the crane does not have to wait for a slave to be present. As soon as a container is loaded on the slave, the crane fetches the next container from the storage area (whether or not there are slaves waiting). If there is no slave upon return of the crane, the crane will wait with the container for the first slave to arrive.

- (iii) For which values of the parameters λ , $E(C_1)$ and $E(C_2)$ is the system stable?

Assume that, on average, 4 slaves per hour arrive at the crane. The time to fetch a container from the storage area is on average 10 minutes with a standard deviation of 8 minutes; the time to load a container on a slave is on average 3 minutes with a standard deviation of 2 minutes.

- (iv) Determine the mean waiting time and the mean sojourn time of a slave.