Module 4 – Practice Questions

Security check

Consider the following situation at a large German airport. Travelers leaving the EU are required to verify their identity using a passport and go through a quick security screening at up to four test points:

- Before moving to the departure area of the airport, each passenger has to go obtain a boarding pass from the airline. The airlines are able to recognize about half of the cases in which a security violation exists.
- Passengers are screened by the German border patrol at the entrance to the departure area. Security standards are higher there, and the border patrol is able to recognize 90% of security violations.
- A third check happens at the gate, again done by the airline. At this stage, only 30% of security violations are recognized, as the agents are busy with boarding the airplane.
- A random subset of 5% of all passengers are chosen for an in-depth screening just before entering the plane. This in-depth screen recognizes 99% of all security violations.

SC1. What is the probability that a passenger who is guilty of a security violation makes it past the gate?

SC2. What is the probability that a passenger who is guilty of a security violation actually boards the airplane?

Cardiac ICU

Consider the following situation in the cardiac ICU at a large hospital. Patients admitted to the ICU from the operating room stay in the ICU, on average, for five days. This, however, assumes that patients do not develop complications.

About 20% of the patients develop complications in the ICU. On average, these patients stay in the ICU for 13 days.

Once discharged from the ICU, patients are moved to the cardiology ward. Here, they spend on average 4 days, assuming they develop no further complications. However, 5% of the patients develop complications in the ward and have to be readmitted to the ICU. In that case, they spend an additional 13 days in the ICU. They then come back to the ward, where they spend on average an additional 4 days.

For this analysis, you can ignore the effects of mortality. There are 12 beds in the ICU and 18 beds in the ward.

CICU1. How many days (on average across all patients) will a patient spend in the ICU?

CICU2. Where is the bottleneck in the process?

CICU3. How many surgeries can the hospital perform per day (ignore any effects related to variability)? In other words, what is the process capacity?

CICU4. How would your answer change if you factored in variability?

   a. The number of surgeries per day would increase.
   b. The number of surgeries per day would decrease.
   c. The number of surgeries per day would stay the same.

Assembly tolerances

An automotive company is evaluating the capability of one of its key suppliers. The supplier delivers a part of the dashboard, and it is critical for the quality of the vehicle that the part measures between 110.45 cm and 110.55 cm. All other parts are labeled as defective.

A random sample of 100 parts that were inspected over the course of the last year revealed that the average measurement was 110.5 cm. The standard deviation was 0.05 cm.

AT1. What is the capability score of the supplier?

AT2. What percentage of the deliveries were likely to be outside the specification limits (outside the interval of [110.45, 110.55])?

AT3. To what level would the supplier have to reduce the standard deviation of the operation if his goal were to obtain a capability score of 1.67 (i.e., get 0.6 defects per million)?