**2.9.**An important part of a project is to identify the key process input variables (KPIV) and key process output variables (KPOV). Suppose that you are in charge of a hospital emergency room. Discuss the KPIVs and KPOVs for this business. How do they relate to possible customer CTQs?

Key Process Input Variables (KPIV)

* Attending physicians (general vs. specialized)
* Nursing staff
* Equipment
  + Beds, medical equipment, technological infrastructure, etc.

Key Process Output Variables (KPOV)

* Measures of quality of patient care
  + Average wait-time before being seen by doctor
  + Patient satisfaction surveys
* Measures of staff performance/satisfaction
* Measures of financial success
  + Costs vs. Sales
  + How well you’ve utilized available government funds

**2.12.** Suppose that your business is operating at the 4.5-Sigma quality level. If projects have an average improvement rate of 50% annually, how many years will it take to achieve Six Sigma quality?

About 10-11 years

**2.13.** Explain why it is important to separate sources of variability into special or assignable causes and common or chance causes.

The objective of the Analyze step of the DMAIC process is to “use the data from the Measure step to begin to determine the cause-and-effect relationships in the process and to understand the different sources of variability.” Separating the sources of variability into common causes and assignable causes is important because addressing each cause typically requires different resources and approaches. For example, a mechanical failure of some equipment would be an assignable cause that has clear and specific ways to address the cause – repair or replace the equipment. However, a common cause of variability such as inadequate training of personnel processing insurance claims might require a more holistic approach that requires addresses multiple steps of the process. In other words, whereas “removing a common cause of variability usually means changing the process, removing an assignable cause usually involves eliminating that specific problem.”

**2.15.** Suppose that during the analyze phase an obvious solution is discovered. Should that solution be immediately implemented and the remaining steps of DMAIC abandoned? Discuss your answer.

If there’s a crucial deadline that needs to be met and there’s just barely enough time to implement the solution, then it might make sense to circumvent the remaining steps and immediately implement the obvious solution. Otherwise, if time allows, the Improve and Control steps of the DMAIC process can add value to the process even if an obvious solution has been discovered by the Analyze step. For instance, the objectives of the Improve step involve adequately documenting how the solution was obtained, what alternative solutions were considered, and an analysis of any potential risks of implementing the solution and plans to counteract those risks. All these objectives are still important even if a solution seems obvious. The objectives of the Control step are also important to ensuring that the solution (however obvious it might have been) can be effectively implemented after the plan is handed over to the process owner.