

## Homework 1

*Due 1/23/25 by the end of the day*

Reminder: Reading Chapter 1-2 of the textbook will help you answer these questions. In lectures 1-2, and part of 3 you will have seen relevant background and examples which should help you solve these problems as well.

- 1) Provide a definition of quality, and state what the two general aspects of quality are.
- 2) What are the four different types of quality costs? (List examples of each)
- 3) Describe what a quality engineering is
- 4) Define the “hidden factory”
- 5) In this problem, refer to the example problem in the lecture notes about using bar coding in a hospital as a basis. For this problem, another hospital decides to launch more thorough investigation. In addition to considering bar-coding, investigators consider 1) assigning fewer patients to each nurse, 2) setting a limit on how much time nurses can spend chatting with patients and 3) shortening the nurses shift hours. In addition to the correct dosage administration, they want to evaluate the job satisfaction of nurses. What are the controllable input variables, and key output variables in this new example?
- 6) Describe what a Control Chart is and how it helps Quality Engineers do their job
- 7) Define what Six Sigma is, the three elements for its successful execution and why it is called Six Sigma
- 8) You are working for a company that makes electrodes. One of the quality characteristics is the loading of catalyst ( $\text{mg}/\text{cm}^2$ ). The target is  $3 \text{ mg}/\text{cm}^2$  and acceptable limits are  $2.4\text{--}3.6 \text{ mg}/\text{cm}^2$ . With the current process, the standard deviation (remember this is sigma or a measure of variance) is  $0.3 \text{ mg}/\text{cm}^2$ . What sigma quality level is the current process at? What would the standard deviation need to be to reach a six sigma level performance?
- 9) Describe why slow processes are expensive and why lean focuses on eliminating waste by increasing process cycle efficiency and decreasing process cycle time
- 10) Describe the main objectives of the Define Step are and why it is a vital part of the DMAIC process.
- 11) Create an SIPOC diagram for the process of making a burger at a fast food restaurant (from making to delivery to customer)
- 12) Create a value stream map for the process of burger making above (include all steps – even those that might not be value added). List estimated process times and suggest ways to improve the process cycle time.

- 13) Use the following table of nonconformity counts and costs of non-fatal pacemaker failures, construct a) a Pareto chart of the count of non-conformities (count), and b) a cost Pareto chart of non-conformities. Make these charts by hand.

Category	Count	Cost
Battery life	12	113850
Irreg. heart beat	2	700
Electro. shielding	1	110000
Discomfort	1	350
Lethargy	1	350

- 14) Comment on which two non-conformities should be the subject of a process improvement effort in problem 13.
- 15) Use Mini-tab to generate the two graphs you sketched in problem 13:
- Open Mini-tab
  - Label columns as "category" "Count" and "Cost"
  - Input the correct values from the chart under each heading
  - Go to Stat, Quality Tools, Pareto Chart
  - Construct both graphs by defining the attribute data is the "category" column (to select, you have to double click and it will appear in the box, then define the frequencies as either "Count" or "Cost" depending on which graph you are making.
  - Hint: you may need to select the box that says not to combine categories to ensure all of the categories make it onto the graphs
- 16) Describe what role a pareto chart can play lean manufacturing
- 17) Describe the objectives of the Measure, Analyze, Improve and Control Steps of the DMAIC process.
- 18) Use the following FMEA table constructed for a cookie baking process, which defect requires the most attention?

Defect	Severity	Occurrence	Detection	RPN
Burnt	6	2	1	
Too dry	4	2	2	
Too small	5	2	1	
Taste is off	9	2	4	
Freshness	8	3	4	
Number of chips is low	2	2	4	