ECHE313 Homework 1 - Due 1/23/15 **Trevor Swan (tcs94)**

1. Quality is simply a product's fitness for use. Its two aspects are:
(i) Quality of design – is a product high quality?
(ii) Quality of conformity – is the product consistently high quality?

2. (i) Prevention Costs – Product/Process design, Training personnel, Process control
(ii) Internal Failure Costs – Scrap, Rework/Retest, Failure Analysis
(iii) Appraisal Costs – Product inspection & testing, Maintaining accuracy of test equip.
(iv) External Failure Costs – Warranty charges, Liability costs, returned product/material

3. Quality Engineering is a set of activities that work to ensure that quality characteristics are kept at desired levels, and that variability is at its minimum.

4. The hidden factory is the part of a plant that the customer doesn't see which deals with bad quality.

5. Controllable Input Variables: Barcoding, # of patients per nurse, time limit on nurse-patient interactions, nurse shift length
Key output variables: Correct amount of drug/dosage, Job satisfaction of their employed nurses

6. Control charts are a form of monitoring which tracks averages in a quality characteristic with/over sample number/time. They are helpful as they indicate where a characteristic should be w/o abnormal variation and they alert users to unusual variation through statistically defined control limits.

7. Six Sigma is a statistical based, data driven management approach and cts. quality improvement methodology for eliminating defects in a product, process, or service. In short, it reduces variability to a level where defects are unlikely. Its three elements are: (i) Quality Planning – Listening to the voice of your customer
(ii) Quality Assurance – Establishing a system to prevent quality issues from arising
(iii) Quality Control & Improvement – A set of specific steps & tools to ensure products meet requirements and are improved continuously.
Its name refers to the quality level target such that std dev (σ) or variance (σ^2) is small enough to be within 6σ of the spec limit.

8. USL = 2.4 mg/cm²
LSL = 3.6 mg/cm²
Target = 3 mg/cm²
σ = 0.3 mg/cm³

a) $\frac{|2.4 \text{ mg/cm}^2 - 3 \text{ mg/cm}^2|}{0.3 \text{ mg/cm}^2} = 2$ for current process

b) $\frac{|2.4 \text{ mg/cm}^2 - 3 \text{ mg/cm}^2|}{\sigma \text{ mg/cm}^2} = 6 \Rightarrow \sigma = 0.1 \text{ mg/cm}^2$ for 6σ process

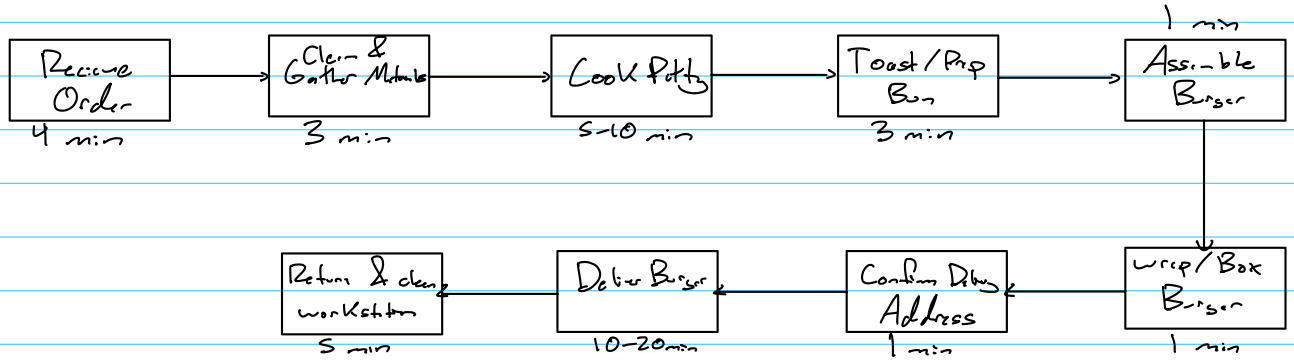
9. Slow processes are expensive as customers don't like waiting (complaint processing), more handling = more personnel & opportunity for damage/loss, more space has to be given to inventory, and more time has to be spent on documentation.
→ Increasing process cycle efficiency results in more product value compared to the same (or less) process time, which results in higher profit.
→ Decreasing Process Cycle time means reducing the number of items in progress (i.e, the backlog), while increasing the completion rate. This results in more products being produced.
Lean focuses on both of these as higher PCE in combination with lower PCT results in more value coming from more sold products

10. The design step is important because it helps identify a project opportunity and verify that it is a legitimate financial opportunity or may lead to major improvement to a process or product. Its main objectives are to:
(i) Identify and/or validate the business improvement opportunity
(ii) Define critical customer requirements
(iii) Document/map processes
(iv) Establish project charter & build team

11.

Suppliers	Inputs	Process	Output	Customer
Butcher/Processing plant	Raw Burger	(i) Receive Cust. Order	Prepared Burger	Customers in-store
Bakery	Burger Buns	(ii) Gather Materials	Cust. Satisfaction	Customers online
Farms	Lettuce, Tomato, Onions	(iii) Cook Patty on Grill	Sales revenue	Delivery services
Cheese Supplier	Cheese slices	(iv) Toast & Prep Bun	Positive reputation	Event organizers
Condiment Company	Sauces/spreads	(v) Assemble Burger	Feedback	Other organizations
Packaging Company	Packaging materials	(vi) Wrap/Box burger		Caretakers
Equipment Company	cooking tools	(vii) Confirm Cust. Details		Family Members
Employees	Employee Labor	(viii) Deliver Burger		Significant Others
		(ix) Return to clean		

12.



Areas for improvement:

(i) Keep all materials out and clean during the work-day

(ii) Toast Bun while Burger is cooking (towards end of grilling time) to faster and better (warmer/fresher) product

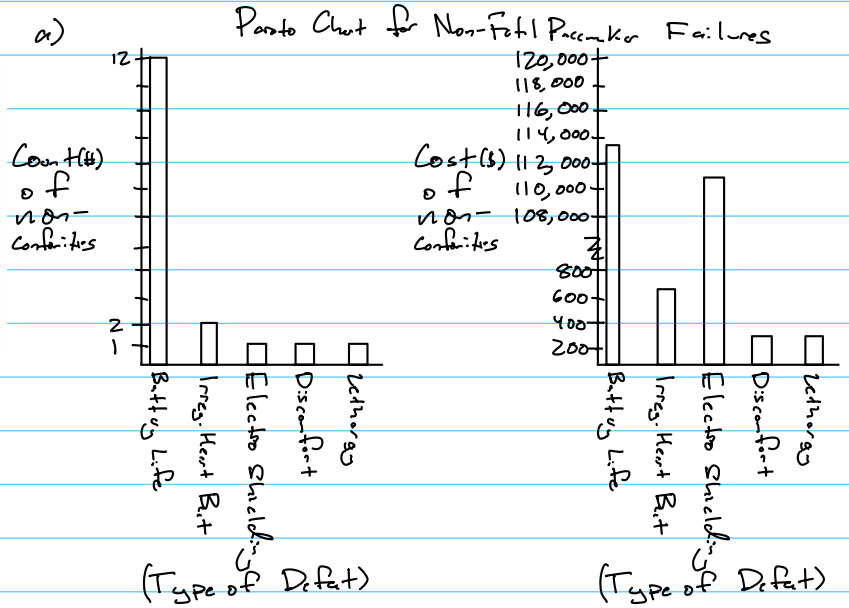
(iii) Confirm Delivery Address upon getting order

(iv) If performing multiple deliveries, make burgers in bulk and find a good route to deliver all burgers to customers quickly

13.

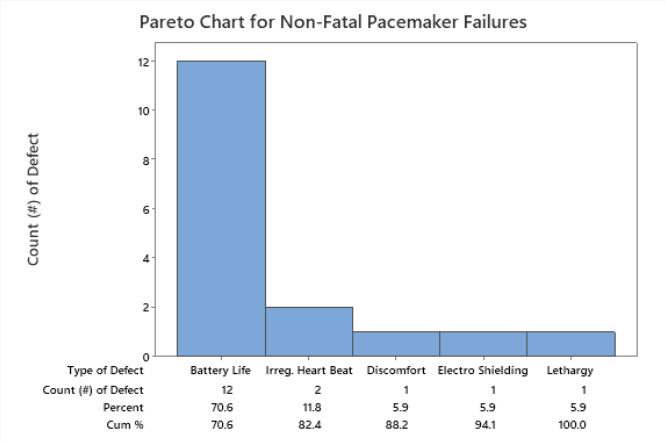
Category	Count	Cost
Battery life	12	113850
Irreg. heart beat	2	700
Electro. shielding	1	110000
Discomfort	1	350
Lethargy	1	350

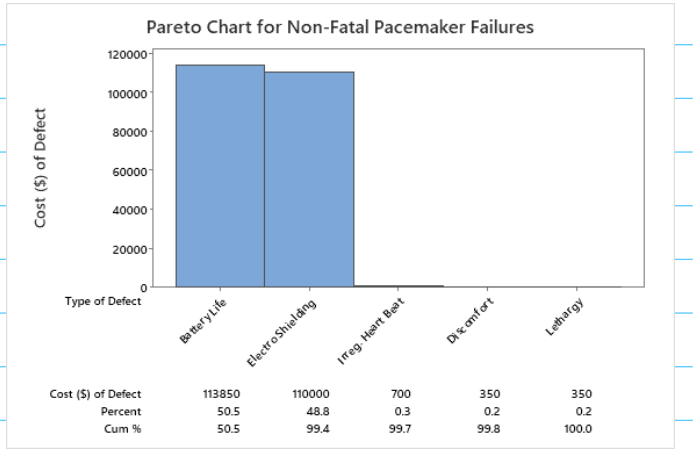
a)



14. While Battery Life and Irregular heart beat are most common, the frequency of the Irregular heart beat defect is not high enough to outweigh the cost of an Electro-shielding defect. As supported by the Cost vs. Defect pareto chart, Battery Life & Electro shielding should be the subject of a process improvement effort.

15.





16. Lean Manufacturing aims at eliminating waste (time or materials). A pareto chart shows opportunities of improvement based off the 80/20 rule (pareto rule). This suggests a few defect types could contribute to the majority of product rejections. Analyzing Pareto charts is done to reduce defects by highlighting significant areas of improvement, eliminating/reducing waste in the form of time wasting from dealing with bad product, and material wasting in the form of rejecting bad product.

17. Measure Objective: Evaluate & understand the current state of the process
Analyze Objective: Use data to begin to determine cause & effect relationships and sources of variability.
Improve Objective: Use creative thinking & info gathered previously to make specific suggestions that will have the desired effect on a process. Confirmation from others is an important aspect of this steps objective.
Control Objective: Complete all remaining work and hand off the improved process so gains in progress are realized/institutionalized.

18.

Defect	Severity	Occurrence	Detection	RPN
Burnt	6	2	1	12
Too dry	4	2	2	16
Too small	5	2	1	10
Taste is off	9	2	4	72
Freshness	8	3	4	96
Number of chips is low	2	2	4	16

Freshness has the highest RPN, and thus requires the most attention

Severity x Occurrence x Detection