Lecture # 38

Prof. John W. Sutherland

Nov. 30, 2005

MichiganTech

Quality Engineering (MEEM 4650 / 5650)
Dept. of Mechanical Engineering - Engineering Mechanics
Michigan Technological University

Chapter 13
Control Charts -- Attribute Data

- What is an attribute?

- Definitions
  - Defect, a fault or nonconformity on an item
  - Defective, an item with one or more defects
  - # of Defectives, d
  - # of Defects, c
  - Fraction Defective, p

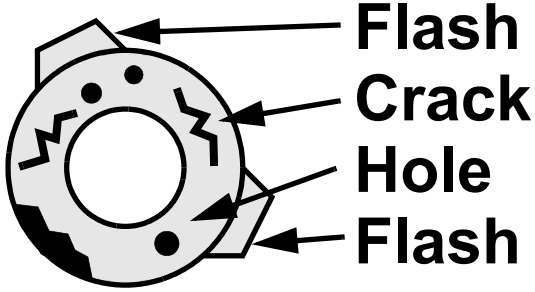
Operational Definitions

- What constitutes a defect??
- Many defects judged visually
- Need to insure that all inspectors are consistent with their decisions
- Need precise, quantitative definitions as to what constitutes a defect.
- Product vs. Process Control (order of checking for defects, visual/non-visual, severity of defects)

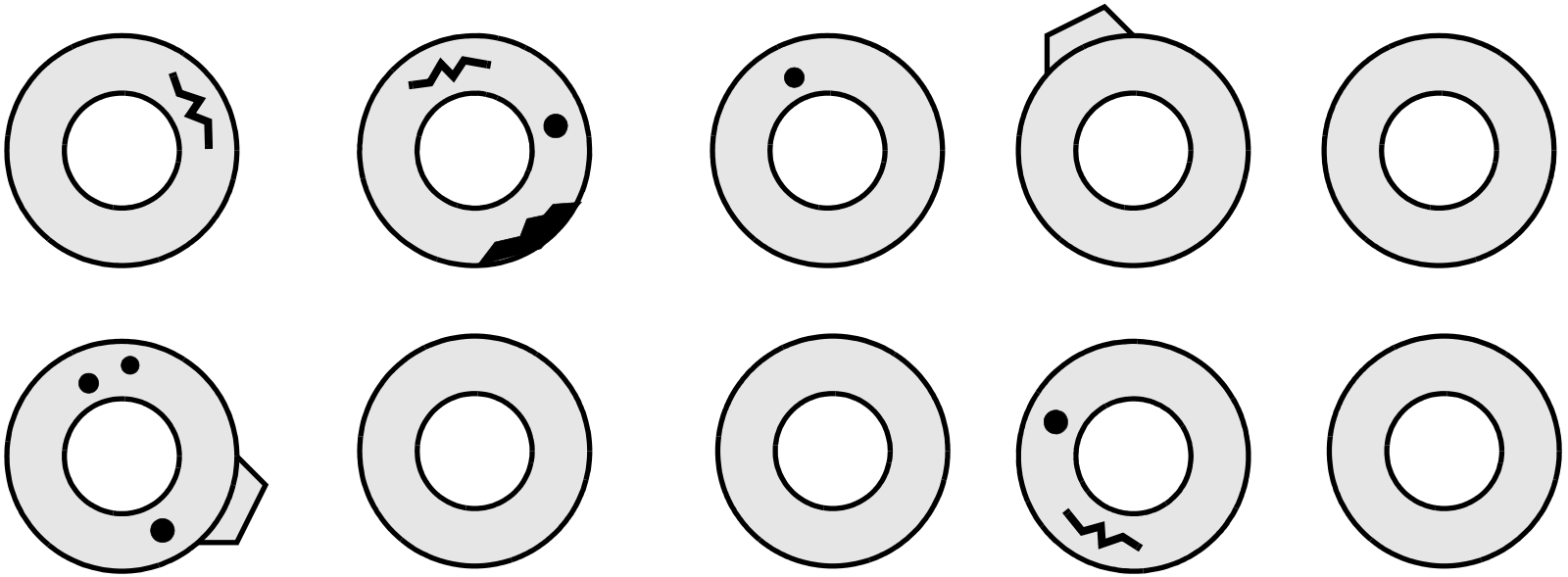
Examples

- **Assembled Engine**
  - **Missing dipstick**
  - **Missing ID tag**
  - **Fail dyno test**
  - **Paint runs**
  - **Bolts missing**

- **Injection molded radiator grille**
  - **Voids**
  - **Oil/grease**
  - **Flash**
  - **Scratches/scuffs**
  - **Black spots**
  - **Splay**
  - **Sinks**
  - **Flow lines**
  - **Burns**
  - **Short shots**



Number of defects = c =
Number of defectives = d =
Fraction defective = p =
Defects/unit = u =

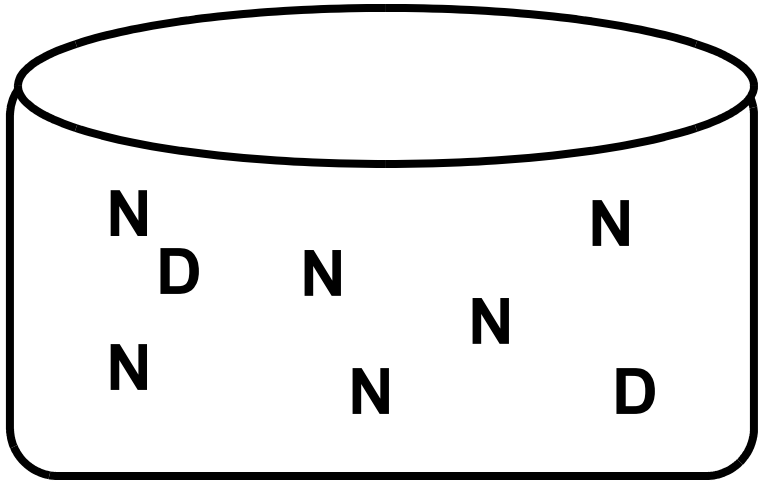


Fraction Defective

- Auto instrument panels
- Types of defects looked for: flash, splay, voids, and short shots
- 30 samples collected (100 panels per shift)
- Number of defectives recorded for each sample
- Fraction defective, p = d/n, calculated for each sample

Refer to Table 13.1 and Figure 13.4 in the text

- To construct control limits for the p values, we need to understand how these values arise in a frequency sense
- This means we need to know about the binomial sampling situation



1,000,000 parts
50,000 defectives
950,000 non-defectives

True Fraction Defective, p'

p' = 0.05

Probability of pulling out a defective?

Probability of pulling out a non-defective?

Binomial Distribution Assumptions

- Only 2 outcomes possible for each trial
- Sampling with replacement
- Independence of successive trials

Probability of getting a defective in one draw?

Probability of getting a conforming item in one draw?

Probability of 2 defectives (D,D)?

Probability of 2 non-defectives (N,N)?

Probability of a defective & non-defective?

Let's say we draw 5 items.

P(5D) =

P(4D,1N) =

P(3D,2N) =

P(2D,3N) =

P(1D,4N) =

P(5N) =

The General Form

$$P(d) = \binom{n}{d}(p')^{d}(1-p')^{n-d}$$

where, $\binom{n}{d} = \frac{n!}{d!(n-d)!}$

what if $\binom{1000000}{2} = ?$