Lesson 15 Acceptance Sampling Solutions

Solved Problem #1: See textbook

#1: Shipments of 300 boxes of glassware are received at a warehouse of a large department store. Random samples of five boxes are checked, and the lot is rejected if more than one box reveals breakage.

Use the appropriate template to answer the following questions.

a. What is the lot size, sample size, and specified rejection number (cut off point) for this sampling plan?

   Lot size – 300 boxes
   Sample size – 5 boxes
   Cut off point – 1 box

b. Construct an Operating Characteristic Curve for this sampling plan.

   [Operating Characteristic Curve Image]

   Operating Characteristic Curve
   P(Accept Lot)

   [Graph showing P(Accept Lot) vs. Lot Quality (% Defective)]

   c. What is the probability of accepting a lot which has 5% defective?

      97.74% (.9774)

   d. Develop the AOQ curve for the sampling plan?
#2: An assembly operation for trigger mechanisms of a semiautomatic spray gun produces a small percentage of defective mechanisms. Management must decide whether to continue the current practice of 100% inspection or to replace defective mechanisms after final assembly when all guns are inspected. Replacement at final assembly costs $30 each; inspection and replacement during trigger assembly costs $12 per hour for labor and overhead. The inspection rate is one trigger per minute.

Answer the following questions.

a. What is the cost of 100% inspection per hour? Per trigger?
   - Per hour: $12
   - Per trigger: $0.20 per trigger ($12/60)

b. If 4% of the trigger mechanisms are defective, what is the cost per hour if they are replaced at final assembly?
   - Per hour: $72
     - 60 triggers per hour * 0.04 defective = 2.4 defective guns (triggers) per hour
     - 2.4 * $30 = $72 per hour
   - Per trigger: $1.20 ($72/60)

e. Assuming 100% inspection, what is the approximate average outgoing quality limit?

   15.96% (.1596)
c. Based on the answers in a. and b., is 100% inspection justified? Why?

Yes, cost of 100% inspection is lower than cost of replacement at final inspection.

d. At what percentage defective would management be indifferent between 100% inspection and replacement at final inspection?

.67% (.0067) Hint: use the equations in a. and b. with the percent defective as an unknown, set them equal, and solve for the percent defective. (i.e. $12 = 60*X*$30)

#3: The quality control manager of a company randomly samples 20 circuit breakers damage caused by shipment in each lot of 4,000 received. Lots with more than one defective are pulled and subjected to 100% inspection.

Use the appropriate template to answer the following questions.

a. What is the lot size, sample size, and specified rejection number (cut off point) for this sampling plan?

Lot size – 4,000 circuit breakers
Sample size – 20 circuit breakers
Cut off point – 1 circuit breaker

b. Construct an Operating Characteristic Curve for this sampling plan.

c. What is the probability of accepting a lot which has 2.5% defective?
d. Develop the AOQ curve for the sampling plan?

![AOQ Curve Image]

Average Outgoing Quality Level

AOQL, 0.0414

Average Outgoing Quality - % Defective

Lot Quality (% Defective)

0.0000 0.0050 0.0100 0.0150 0.0200 0.0250 0.0300 0.0350 0.0400 0.0450

0.00 0.05 0.1 0.15 0.2 0.25 0.3 0.35 0.4 0.45 0.5 0.55 0.6 0.65 0.7 0.75 0.8 0.85 0.9 0.95 1

4.18% (.9118)

e. Assuming 100% inspection, what is the approximate average outgoing quality limit?

4.14% (.0414)

f. The upper limit on the percentage the company is willing to accept is one percent. What is the probability that the company will accept a lot, based on this sampling plan, which is unacceptable?

98.31% (.9831)

#4: Auditors use a technique called \textit{discovery sampling} where if any defectives are found, the lot is 100% inspected.

Use the appropriate template to answer the following questions.

a. Construct an Operating Characteristic Curve for the following discovery sampling plan: 15 accounts out of 8,000 accounts are sampled.
What is the probability of concluding the accounts are acceptable if 5% of the accounts are unacceptable?

46.33% (.4633)

b. Construct an Operating Characteristic Curve for the following discovery sampling plan: 100 accounts out of 8,000 accounts are sampled.
What is the probability of concluding the accounts are acceptable if 5% of the accounts are unacceptable?

.59% (.0059)

c. Suppose you are an auditor, based on the results in a. and b. which audit plan would you choose? Why?

Choose 100 samples. Auditors do not want to make mistakes. A lot with 5% defective seems to be quite large when considering the fiduciary responsibility that accompanies an audit; therefore, 100 samples minimize the auditor’s risk.
#5: Consider a sampling plan where the lot size is 720 and the sample size is 12. For a lot with 5% defective, answer the following questions.

a. Complete the following table for the cut off points by showing the probability of accepting a lot with 2.5% defectives.

<table>
<thead>
<tr>
<th>Cut Off</th>
<th>P(Accept)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>.7380</td>
</tr>
<tr>
<td>1</td>
<td>.9651</td>
</tr>
<tr>
<td>2</td>
<td>.9971</td>
</tr>
<tr>
<td>3</td>
<td>.9998</td>
</tr>
</tbody>
</table>

b. What are your observations?

The probability of accepting a lot with 2.5% defective goes down as the cut off decreases. Equivalently, as the cut off increases the probability of accepting a lot with 2.5% defective increases.