Minitab

SPC

LESSON: Sigma Levels - Homework

Homework 2 NAME:_____

Topics: Sigma Level & DPM Calculations

Solve the following problems and **show your work**.
Throughout the homework set, **assume a Sigma Level** is short term by default, **unless told otherwise**.

1. This problem's information is from the article **1 in 6 Uber and Lyft Cars Have Open Safety Recalls** written by Ryan Felton (5/29/19) and appearing in a recent edition of Consumer Reports. The following paragraph is taken directly from this source:

Of the **93,958 vehicle identification numbers** (VINs) associated with ride-hailing vehicles in New York City and King County, Wash., that CR examined, **15,175 had one or more open safety recalls**. (Because ride-hailing drivers can work for more than one company, we grouped results together for vehicles associated with Uber, Lyft, and, for New York, smaller competitors Juno and Via.)

Assuming **no shift** in the process mean over time, determine the **Long Term Sigma Level** associated with the number of ride-hailing vehicles in these areas that have one or more open safety recalls.

Instructions for submitting your solution:

- Give your answer correctly rounded to 3 decimal places.
- Copy and paste your graphics from Minitab or your expressions from your Maple worksheet either electronically or using scissors & tape.
- Clearly indicate your final answer by circling it, highlighting it, starring it, etc.
- If you're using a word processor, such as Microsoft Word, reduce the size of large graphics and remove multiple lines of empty space. In other words, reduce the amount of paper that you submit (if possible).

2. Circle the correct answer True or False for the following statements. You do not need to show your work for these.

a. Doubling any positive Long Term Sigma Level (e.g. going from 2σ to 4σ) will always cut the number of defects per million by at least a half.
True False

b. The DLE Corporation operates at a yield of 93.32% (non-defective), meaning 6.68% of its products is defective. This corporation is operating at a Short Term Sigma Level of approximately 3σ.
True False

c. Increasing job performance in a corporation from a Short Term Sigma Level of 3.040σ to a Short Term Sigma Level of 4.002σ will cut defects per million by approximately 1/10.
True False

d. A corporation operating at a Short Term Sigma Level of 3σ has approximately1,350 DPM.
True False

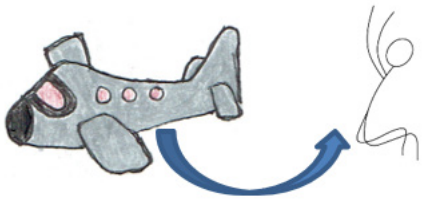
3. This problem's information is from the article **US airlines are bumping more travelers as Boeing 737 Max planes grounded** written by Leslie Joseph and appearing online in a June 5, 2019 post by CNBC. The following paragraph is taken directly from this source:

After boasting record low bumping rates, U.S. airlines in the first three months of this year denied boarding to travelers at the highest rate since 2017, according to Department of Transportation data released Wednesday. The increase was partially driven by the grounding of the Boeing 737 Max, which took more than 70 of the high-capacity planes out of service.

In the first quarter, **6,175 passengers were involuntarily denied boarding**. That is nearly triple the number from the same period a year ago but small in comparison with the **195.7 million passengers** who checked in for flights in those three months.

Assuming **no shift** in the process mean over time, determine the **Long Term Sigma Level** associated with the number of bumped passengers out of the 195.7 million passengers.

Use the "**Instructions for submitting your solution**" (e.g. record the answer correctly rounded to 3 decimal places) as displayed with Problem 1.



4. Over the last 18 years, I have literally had over a million pieces of paper printed at the print shop. From hundreds of lectures and assignments with multiple pieces of paper, I have determined that the print shop only has 63.31 defects per million pieces of paper (DPM). The print shop has **NOT** had a shift in the process mean over the past 18 years. What Long Term Sigma Level (with no shift in the process mean) corresponds to their quality service?

Use the "**Instructions for submitting your solution**" (e.g. record the answer correctly rounded to 3 decimal places) as displayed with Problem 1.

5. If a company is operating at a 4σ Short Term Sigma Level, what proportion of its product is conforming (i.e., non-defective)? Use the "**Instructions for submitting your solution**" (e.g. record the answer correctly rounded to 3 decimal places) as displayed with Problem 1.

6. Six Sigma Calculations for a certain company's call response time:

Customer statement: "I consistently wait too long to speak to a customer representative."
Metric: Time on hold (in seconds) waiting for a customer representative
Defect: Calls with hold times that are at least 60 seconds

Suppose we know that this company's call response time has a Short Term Sigma Level of 4.151σ. How many calls do we expect to be defective out of a million (where defective means being on hold for at least 60 seconds)?

Use the "**Instructions for submitting your solution**" (e.g. record the answer correctly rounded to 3 decimal places) as displayed with Problem 1.

7. Suppose that Beyonce, Jay Z, and Solange go bowling together. Each of them has a bowling average X that is normally distributed with mean $\mu = 120$ and standard deviation $\sigma = 10$. Assuming their scores are independent of each other's, determine the following probabilities.

a. What is the probability that Jay Z's score is more than 130? Give your answer correctly rounded to **3 decimal places**.

b. What is the probability that none of the 3 get a score greater than 130? Give your answer correctly rounded to **3 decimal places**.

c. What is the probability that at least one of them gets a score greater than 130? Give your answer correctly rounded to **3 decimal places**.

8. Suppose I know that my company has problems with its process mean drifting from the target by **2σ** (instead of the typical short term drift of 1.5σ). How many defects per million would a Short Term Sigma Level of 5σ have given the shift of 2σ (instead of 1.5σ)?

Use the "**Instructions for submitting your solution**" (e.g. record the answer correctly rounded to 3 decimal places) as displayed with Problem 1.

9. I have read parts of the book: "**Straight from the Gut**" by the Quality Guru **Jack Welch** (former GE CEO who popularized Six Sigma). He has the following quote on page 334: "A Black Belt team solved the problem and designed a change in the production process that gave the color and static qualities that Sony demanded. We went from **3.8σ** to **5.7σ** and earned Sony's business." Assume these are Short Term Sigma Levels and that a shift of 1.5σ occurs.

a. As a 3.8σ Short Term Six Sigma company, how many defects per million were they producing? You can round your answer to the nearest integer due to the number of decimal places given in the Minitab output.

b. As a 5.7σ Short Term Six Sigma company, how many defects per million were they producing? You can round your answer to the nearest integer since you did this in part (a).

10. This problem's information is from the article **Fisher-Price Recalls Millions of Rock 'n' Play Sleepers After '30 Baby Deaths**' written by Rebecca Perring and appearing online in an April 15, 2019 post by Express Online. The following paragraph is taken directly from this source:

Fisher-Price toymaker has recalled nearly 5 million of its Rock 'n' Play sleepers after reports 30 babies had died in ten years after using them.

Assuming **no shift** in the process mean over time, determine the **Long Term Sigma Level** associated with 30 of 5 million Rock 'n' Play sleepers being defective.

Use the "**Instructions for submitting your solution**" (e.g. record the answer correctly rounded to 3 decimal places) as displayed with Problem 1.