QUESTIONS:

1. **A/An _____ is a type of estimation that uses a single value, oftentimes a sample statistic, to infer information about the population parameter as a single value or point.**
   - Interval estimate
   - Confidence level
   - Sample Statistic
   - Point estimate

2. **A/An _____ is a type of estimation that uses a range (or interval) of values, based on sampling information, to "capture" or "cover" the true population parameter being inferred.**
   - Point estimate
   - Confidence level
   - Interval estimate
   - Significant level

3. **Calculate the point estimate for the sample mean using the following 5 sample data points:**

   119, 121, 132, 125, 129
   - 129.0
   - 125.2
   - 123.5
   - 124.0

4. **A Glass & Mirror Manufacturer wants to reduce in process scrap by 25%. The team agrees the first step in the improvement process is to collect data to determine the categories of scrap occurring within the process. Which tool can be used to collect data?**
   - Pareto Chart
   - Flow Chart
   - Cause & Effect Diagram
   - Check Sheet

5. **What is the critical z-value associated with a 2-sided confidence interval with a 10% alpha risk?**
   - z-score = 1.29
   - z-score = 1.96
   - z-score = 1.78
   - z-score = 1.65

6. **You've been tasked with improving a process, and you've identified that variation in your equipment tooling is causing variation within your process that's resulting in yield loss. You're in the process of adding an alignment feature to your tooling to mistake-proof the process. Which phase of the DMAIC process are you in?**
   - Measure
   - Analyze
   - Improve
   - Control

7. **You've sampled 75 units from the latest production lot to measure the width of the product. The sample mean is 8.15in and the population standard deviation is known to be 0.92in. Calculate the 95% confidence interval for the population mean.**
   - 8.15 ± 0.920
   - 8.15 ± 0.175
   - 8.15 ± 0.106
   - 8.15 ± 0.208

8. **In DOE, which term reflects a unique combination of factors and levels within an experiment?**
   - Power
   - Replication
   - Block
   - Treatment

9. **Which value of the normal distribution is a measure of the central tendency & often exists at the peak & centerline of the distribution?**
   - Mean
   - Range
   - Standard Deviation
   - Variance

10. **You are part of a team which tries to investigate on the root cause of a recent nonconformance. The team is using fishbone diagram to find causes and effects. Which tool can be combined with the fishbone diagram to gather more ideas from team members regarding the root cause of the problem?**
    - Scatter Plot
    - PDCA
    - Brainstorming
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SOLUTIONS:

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$$\textbf{\textit{Sample Mean}}: \ \bar{X} = \frac{\sum x}{n} = \frac{119 + 121 + 132 + 125 + 129}{5} = \mathbf{125.2}$$

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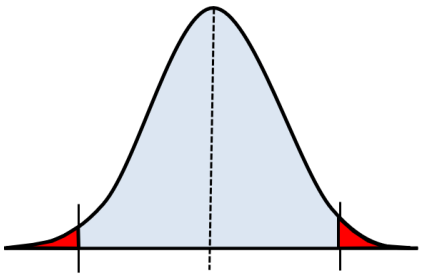
5. What is the critical z-value associated with a 2-sided confidence interval with a 10% alpha risk?

- z-score = 1.29
- z-score = 1.96
- z-score = 1.78
- **z-score = 1.65**

Because it's a 2-sided distribution with at the 10% significance level, we're looking for the z-score that's associated with the area under the curve of 0.450 (0.450 = 0.500 - 0.050). This would capture 45% on the left half & right half of the distribution, leaving the remaining 10% of the alpha risk in the rejection area of the tails of the distribution. **The z-score associated with 0.450 probability is z = 1.65**

Area under the Normal Curve from 0 to X

X	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.00000	0.00399	0.00798	0.01197	0.01595	0.01994	0.02392	0.02790	0.03188	0.03586
0.1	0.03983	0.04380	0.04776	0.05172	0.05567	0.05962	0.06356	0.06749	0.07142	0.07535
0.2	0.07926	0.08317	0.08706	0.09095	0.09483	0.09871	0.10257	0.10642	0.11026	0.11409
0.3	0.11791	0.12172	0.12552	0.12930	0.13307	0.13683	0.14058	0.14431	0.14803	0.15173
0.4	0.15542	0.15910	0.16276	0.16640	0.17003	0.17364	0.17724	0.18082	0.18439	0.18793
0.5	0.19146	0.19497	0.19847	0.20194	0.20540	0.20884	0.21226	0.21566	0.21904	0.22240
0.6	0.22575	0.22907	0.23237	0.23565	0.23891	0.24215	0.24537	0.24857	0.25175	0.25490
0.7	0.25804	0.26115	0.26424	0.26730	0.27035	0.27337	0.27637	0.27935	0.28230	0.28524
0.8	0.28814	0.29103	0.29389	0.29673	0.29955	0.30234	0.30511	0.30785	0.31057	0.31327
0.9	0.31594	0.31859	0.32121	0.32381	0.32639	0.32894	0.33147	0.33398	0.33646	0.33891
1.0	0.34134	0.34375	0.34614	0.34849	0.35083	0.35314	0.35543	0.35769	0.35993	0.36214
1.1	0.36433	0.36650	0.36864	0.37076	0.37286	0.37493	0.37698	0.37900	0.38100	0.38298
1.2	0.38493	0.38686	0.38877	0.39065	0.39251	0.39435	0.39617	0.39796	0.39973	0.40147
1.3	0.40320	0.40490	0.40658	0.40824	0.40988	0.41149	0.41309	0.41466	0.41621	0.41774
1.4	0.41924	0.42073	0.42220	0.42364	0.42507	0.42647	0.42785	0.42922	0.43056	0.43189
1.5	0.43319	0.43448	0.43574	0.43699	0.43822	0.43943	0.44062	0.44179	0.44295	0.44408
1.6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.45053	0.45154	0.45254	0.45352	0.45449
1.7	0.45543	0.45637	0.45728	0.45818	0.45907	0.45994	0.46080	0.46164	0.46246	0.46327



Significance Level (α)	Confidence Level (100 – α)	Two-tailed Sign. Level $(\alpha_{/2})$	$Z\alpha_{/2}$
0.01	99%	0.005	2.575
0.05	95%	0.025	1.960
0.10	90%	0.05	1.645

6. **You've been tasked with improving a process, and you've identified that variation in your equipment tooling is causing variation within your process that's resulting in yield loss. You're in the process of adding an alignment feature to your tooling to mistake-proof the process. Which phase of the DMAIC process are you in?**
   - Measure
   - Analyze
   - **Improve**
   - Control

   In the **Improve** phase of **DMAIC** is when you would add mistake-proofing tools like alignment features to equipment to eliminate a source of variation.

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   - 8.15 ± 0.920
   - 8.15 ± 0.175
   - 8.15 ± 0.106
   - $\mathbf{8.15 \pm 0.208}$

   Because we've sampled more than 30 units and the population standard deviation is known, we can use the Z-score approach to this confidence interval problem. We need to find the Z-score associated with the 95% confidence interval using the Z-Table, we find Z = 1.96.

$$Interval\ Estimate\ of\ Population\ Mean\ (known\ variance)\text{: } \bar{x} \pm Z_{\frac{\alpha}{2}} * \frac{\sigma}{\sqrt{n}}$$

$$Interval\ Estimate\text{: } 8.15 \pm 1.96 * \frac{0.92}{\sqrt{75}} = \mathbf{8.15 \pm 0.208}$$

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   - Power
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    - **Brainstorming**
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    Brainstorming and 5Whys are common tools which are usually combined with the fishbone diagram in the root cause investigation phase.