

**Quality Management and Metrology (MEC-E1090)**  
2019 Examination

Name:

ID:

**Question 1.**

Suppose supplier A has provided a sample of 20 parts which upon inspection show a Cp of 1.18 and a Cpk of 1.09. Another Supplier B has provided a sample of 20 parts with upon inspection show a Cp of 1.69 and a Cpk of 0.90.

Which supplier would you rather work with and why?

**Question 2.**

A company is selling small plastic molded parts. They sell in lots of 10,000s. They inspect the parts as they pass on a conveyor belt before shipment using pass/fail visual inspection of the shape and color. A repeatability and reproducibility study showed their inspection precision produces correct judgements 99% of the time. How much of a problem is this? What would you suggest they do and how?

**Question 3.**

What are gage blocks?

How is a laser interferometers used in gage block calibration?

**Question 4.**

Considering a measuring instrument:

What is bias?

What is precision?

What is reproducibility?

What is linearity?

**Question 5.**

Given the following GRR analysis report,

- what is the PT ratio?
- what the %RR?
- Are they acceptable?
- What ought be improved to increase precision?
- Can you use the gage to measure parts for specification compliance? Why or why not?
- Can you use the gage to measure parts for statistical process control? Why or why not?

Gage R&R				
Source	VarComp	% Contribution (of VarComp)		
Total Gage R&R	0.6306	0.89		
Repeatability	0.0833	0.12		
Reproducibility	0.5472	0.78		
Operator	0.4917	0.70		
Operator*Part	0.0556	0.08		
Part-To-Part	69.8886	99.11		
Total Variation	70.5192	100.00		
Source	StdDev (SD)	Study Var (6* SD)	%Study Var (%SV)	% Tolerance (SV/Tol)
Total Gage R&R	0.794075	4.76445	9.46	39.70
Repeatability	0.288675	1.73205	3.44	14.43
Reproducibility	0.739745	4.43847	8.81	36.99
Operator	0.701189	4.20714	8.35	35.06
Operator*Part	0.235702	1.41421	2.81	11.79
Part-To-Part	8.359943	50.15966	99.55	418.00
Total Variation	8.397571	50.38543	100.00	419.88

### Question 6.

Suppose you are interested in hiring a manufacturer in a foreign country. They are ISO certified. Why is the quality policy important to read? What would you look for?

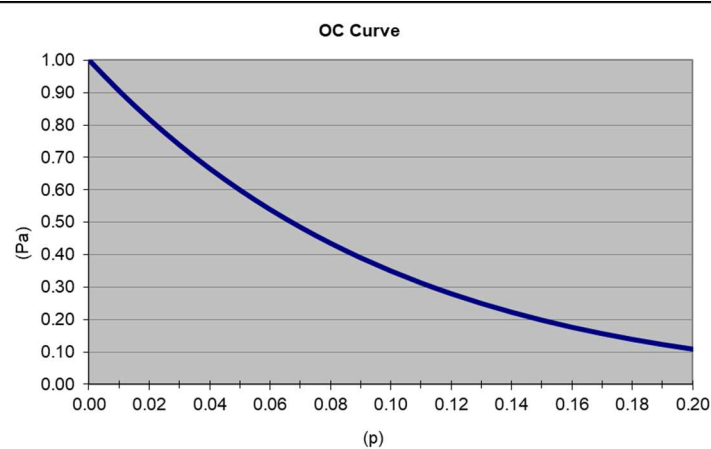
### Question 7.

What is Root Cause Analysis and what is it used for?

### Question 8

A customer is using an inspection plan requiring 50 samples from a lot with no defects allowed for the lot to be accepted. This generates the following OC curve using the binomial distribution function.

What must the quality level be for 90% confidence that a lot will be accepted?



### Question 9.

What is an Xbar-R chart and how is it useful:

- (a) When your product quality levels have a  $C_p = 0.8$  and  $C_{pk}$  of 0.7?
- (b) When your product quality levels have a  $C_p = 1.5$  and  $C_{pk}$  of 1.2?

### Question 10.

A PPAP package includes additional contracting requirements beyond a traditional quality assurance supplier contract. Why are the following part of a supplier's PPAP package important to the customer's quality control?

Measurement Plan  
Control Plan  
Cpk data

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Suppose supplier A has provided a sample of 20 parts which upon inspection show a Cp of 1.21 and a Cpk of 1.15. Another Supplier B has provided a sample of 20 parts with upon inspection show a Cp of 1.62 and a Cpk of 0.91.

Which supplier would you rather work with and why?

**Question 2.**

A company is selling small plastic molded parts. They sell in lots of 10,000s. They inspect the parts as they pass on a conveyor belt before shipment using pass/fail visual inspection of the shape and color. A repeatability and reproducibility study showed their inspection precision produces correct judgements 99% of the time. How much of a problem is this? What would you suggest they do and how?

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Gage R&R		% Contribution		
Source	VarComp	(of VarComp)		
Total Gage R&R	1.0073	27.89		
Repeatability	0.7563	20.94		
Reproducibility	0.2510	6.95		
Operator	0.2510	6.95		
Operator*Part	0.0000	0.00		
Part-To-Part	2.6047	72.11		
Total Variation	3.6120	100.00		
		Study Var	%Study Var	% Tolerance
Source	StdDev (SD)	(6* SD)	(%SV)	(SV/Tol)
Total Gage R&R	1.003643	6.02186	52.81	5.02
Repeatability	0.869674	5.21805	45.76	4.35
Reproducibility	0.500965	3.00579	26.36	2.50
Operator	0.500965	3.00579	26.36	2.50
Operator*Part	0.000000	0.00000	0.00	0.00
Part-To-Part	1.613906	9.68343	84.92	8.07
Total Variation	1.900524	11.40314	100.00	9.50

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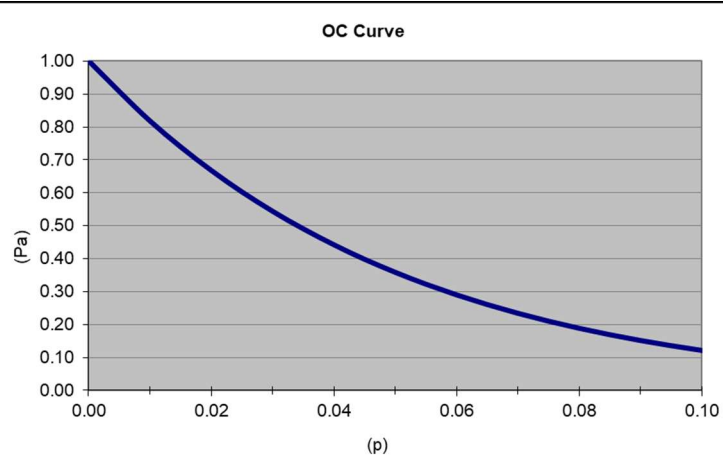
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