

Lean Six Sigma Black Belt Sample Questions

ENG_15Qs

Study: Lean Six Sigma – Black Belt

Instructions:

1. All 15 questions should be attempted.
2. All answers are to be marked on the answer sheet provided by using a pen.
3. There is only one correct answer per question.
4. You have 45 minutes for this paper.
5. You must get 10 or more correct to pass.
6. You are allowed to use your own notes, training hand-outs (binders), a dictionary plus maximum 2 other books
7. You are allowed to use a laptop computer with Minitab.
8. Use of other sources of information within the exam room, or outside the exam room by means of digital equipment, is not allowed.

Candidate Name: _____

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- 1 A new team of medical students have been working together for a few weeks. A query has been raised about the height/weight ratio used when calculating Body Mass Index. Having learned that one member of the team has a background in health and fitness training, the rest of the team turned to that member for guidance.

In what stage of development is this team?

- a. Forming
- b. Storming
- c. Norming
- d. Adjourning

- 2 An X-bar and Range control chart is based on a sample size of 4. An operator mistakenly samples 2 parts instead of 4. The average and the range of the two observations are plotted on the control chart.

Which statement **BEST** describes the effect of this mistake?

- a. Observations from a sample of 2 will always be nearer the centre lines of the charts
- b. Increase the probability that the R chart shows an out-of-control condition
- c. Increase the probability that the Xbar chart shows an out-of-control condition
- d. Will not cause any misjudgements if the process is in control

- 3 An improvement team has been working within an open plan office environment to improve work place organization. Many items have been red tagged and staff were given one week to write on the red tags how often an item is used. Many red tagged items have been simply discarded when a week later no-one has written on the tag. Additional purchases have been made of any items that were noted as being needed continuously for work. Items that were noted as being used on a daily basis have been placed close where staff work whereas items that are used less often have been placed in a cupboard in the stockroom on the next floor. A diagram of the layout of the cupboard has been laminated and attached to the outside of the cupboard door. The staff were all shown the new layout and the manager includes the area on a weekly 'audit' routine.

Which might be improved?

- a. It was wrong to discard items that had not been claimed
- b. It was a waste of money to buy additional items
- c. It was wrong to put so much in the cupboard
- d. The diagram should be on the inside of the cupboard

4 A bicycle manufacturer is planning to design and launch a new super lightweight range of road bicycles. It is understood that the market for this range of products has grown exponentially with the boom in triathlons. Race participation has shown an increase of more than 300% in the past three years.

At which stage in the product lifecycle should the manufacturer forecast profits from this new range to reach its peak?

- a. Development
- b. Growth
- c. Maturity
- d. Decline

5 The manager of a coffee shop has created a list of customer requirements by listening to complaints, handing out surveys, holding focus groups and conducting interviews. One common need was Good Customer Satisfaction. In order to understand what it is that fulfils this need, the coffee shop manager has created a Critical to Quality (CTQ) Tree:

Is the data below an appropriate translation of the Voice of the Customer (VOC) into Critical to Quality (CTQ) metrics?

Need	Quality Driver	Critical to Quality
	Price	<ul style="list-style-type: none"> ▪ Range €2.00 - €3.50
	Coffee on Offer	<ul style="list-style-type: none"> ▪ Number of choices offered ▪ Tasty coffee ▪ Fresh - no older than 5 minutes
	Staff	<ul style="list-style-type: none"> ▪ Good pleasant staff ▪ Prompt service < 5 minutes
	Surroundings	<ul style="list-style-type: none"> ▪ Pleasant ambiance

- a. No, because the price should be a single fee rather than a range
- b. No, because ambiance is subjective and not operationalized
- c. Yes, because the quality drivers cover a wide range of factors
- d. Yes, because this diagram should identify the factors of influence

- 6 When evaluating 100 dice throws for goodness-of-fit to the expected distribution with 95% confidence, which of the following statements are true?

Category	Observed	Test Proportion	Expected	Contribution to Chi-Sq
1	13	0.166667	16.667	0.80667
2	26	0.166667	16.667	5.22667
3	19	0.166667	16.667	0.32667
4	13	0.166667	16.667	0.80667
5	9	0.166667	16.667	3.52667
6	20	0.166667	16.667	0.66667

1. The alternate hypothesis for the test is accepted
2. Critical value for the Chi-square statistic is 11.07
3. Expected data follow a Chi-Square distribution
4. Calculated chi-Square statistic is insignificant at the 2.5% level

- a. 1, 2, 3
- b. 1, 2, 4
- c. 1, 3, 4
- d. 2, 3, 4

- 7 To calculate process capability of non-normal data a Box-Cox transformation is used with a lambda = 0.5.

What would be the effect on the USL of 16 in the transformed graph?

- a. Remains at 16
- b. Changed to 8
- c. Changed to 4
- d. Changed to 256

- 8 A continuous process has five consecutive steps. The time it takes for one person to process one piece is the touch time. Assume Takt Time = 4.5 minutes and touch times have no variation. In each 8 hour shift the employees take 30 minutes for lunch and two 15 minute breaks.

Step	WIP	Touch Time (Minutes)	Employees
A	10	8	2
B	40	15	3
C	2	3	1
D	10	20	5
E	2	12	4

What is the **BEST** action that can be taken to improve the flow of this process?

- a. Increase employees, Work in Process (WIP) is growing
- b. Decrease employees, the process is over producing
- c. Keep the total employees the same, train for multi-skilling
- d. Pay the employees to work through one 15 minute break each shift

- 9 The sales director of a vehicle breakdown recovery company has voiced concerns about the introduction of a new sales process. While fully supporting the need for a change to the existing process, the sales director has little confidence that it will be readily adopted by the sales teams and does not believe it will be successful.

Consensus on Content	++ +	Coalition Partner (2)	Coalition Partner (2)	Ally (1)
	++	Opponent (4)	Skeptic (3)	Skeptic (3)
	+	Enemy (6)	Opponent (5)	Opponent (5)
		+	++	+++
Confident in Result				

What is the relationship of the sales director to this program?

- a. Coalition partner
 - b. Ally
 - c. Opponent
 - d. Skeptic
- 10 Given the following output of a gage R&R study:

Source	% Study Variation
Total Gage R&R	9.52
Repeatability	7.70
Producibility	5.59
Operator	5.59
Part-to-Part	99.5
Total Variation	100.00

What can be deduced from the study?

1. The %contribution of Total Gage R&R is about 10%
2. There is no part * operator interaction
3. The measurement system is classified as ideal
4. Part-to-Part is the largest cause of Study variation

- a. 1, 2, 3
- b. 1, 2, 4
- c. 1, 3, 4
- d. 2, 3, 4

- 11 Assuming all data in the table below is accurate, a shift manager has been asked to calculate the Overall Equipment Effectiveness (OEE) during this shift.

Shift Length	7 Hours 30 Minutes
Coffee Breaks	2 x 15 Minutes
Lunch Break	30 Minutes
Production Time	6 Hours 30 Minutes
Down Time	33 Minutes
Loading Time	5 Hours 37 Minutes
Availability Rate	91.54%
Ideal Production Rate	44 Items / Minutes
Items Produced During Shift	14,300
Performance Rate	91.04%
Number Of Defects	610
Quality Rate	99.96%

The shift manager has submitted an OEE of 83.30%. Is this correct?

- a. No, because OEE is the sum of the three different 'Rates' when added together
- b. No, because OEE should be the same as the Quality Rate
- c. Yes, because OEE should be the total of the three different 'Rates' when multiplied together
- d. Yes, because the OEE is the percentage that the machine is running within the available time

12 The costs and benefits of an improvement project are summarized in the table below.

	Year 0	Year 1	Year 2
Cost of Team	€10,000	€0	€0
Capital Cost	€20,000	€0	€0
Reduction in Defects	€0	€15,000	€15,000
Resources Redeployed	€0	€9,000	€9,000

An interest rate of 5% can be assumed for the cost of money. Which of the following are true?

1. The ROI at year 1 is -20%
 2. The ROI at year 2 is 60%
 3. The NPV is €14,600
 4. The NPV is €13,900
- a. 1, 2, 3
 - b. 1, 2, 4
 - c. 1, 3, 4
 - d. 2, 3, 4

- 13 A 2-level Full Factorial design with 4 quantitative factors A, B, C and D is created. 4 centre points and no replicates are used. The results of the analysis are below.

Factorial Regression: Response versus A; B; C; D

Analysis of Variance

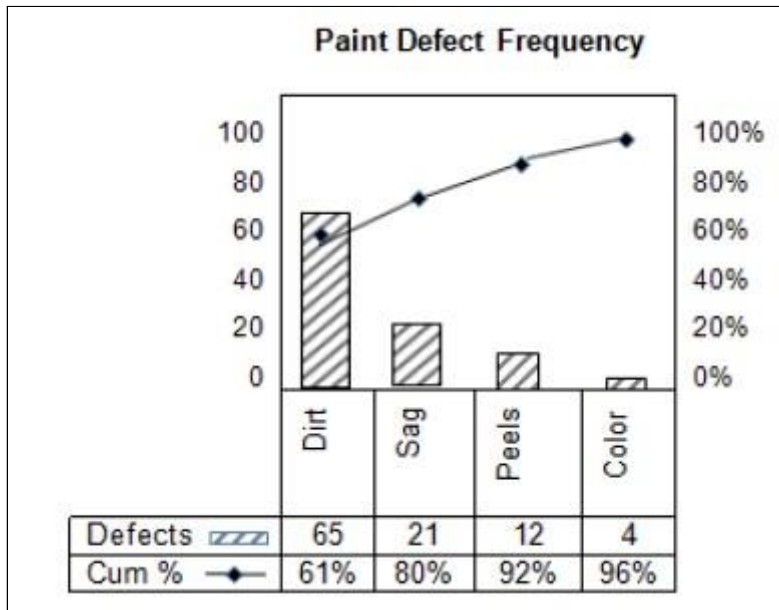
Source	DF	Adj ss	Adj ms	F-Value	P-Value
Model	11	2802.20	254.75	58.65	0.000
Linear	4	2701.25	675.31	155.47	0.000
A	1	256.00	256.00	58.94	0.000
B	1	2304.00	2304.00	530.42	0.000
C	1	20.25	20.25	4.66	0.063
D	1	121.00	121.00	27.86	0.001
2-Way Interactions	6	93.75	15.62	3.60	0.049
A*B	1	4.00	4.00	0.92	0.365
A*C	1	2.25	2.25	0.52	0.492
A*D	1	0.00	0.00	0.00	1.000
B*C	1	6.25	6.25	1.44	0.265
B*D	1	81.00	81.00	18.65	0.003
C*D	1	0.25	0.25	0.06	0.816
Curvature	1	7.20	7.20	1.66	0.234
Error	8	34.75	4.34		
Lack-of-Fit	5	6.00	1.20	0.13	0.976
Pure Error	3	28.75	9.58		
Total	19	2836.95			

Evaluate the table. Use a 5% significant level. What is the conclusion?

- Main effects A and C are significant
- 3 main effects and the 2-way interaction B*D are significant
- There is no significant main effect, just 2 way interactions B*D and A*C
- All response observations are insignificant

14 The Pareto chart below shows the paint defects from an automotive assembly plant.

The assembly plant manager has decided that there is no question as to which problem needs to be addressed first, the 'Dirt' defect.



Is the assembly plant manager correct in this conclusion?

- a. No, because cumulatively 'Color' represents the highest percentage of all defects
- b. No, because 80% of the defects should be resolved by fixing 20% of the problems
- c. Yes, because cumulatively 'Dirt' represents the lowest percentage
- d. Yes, because 'Dirt' is the most frequently occurring reason for defects

- 15 An economist wants to predict how much a person is spending on a new car. 'Income', 'IQ', 'Age' and 'Vacation' (how much a person spends on a vacation) are included as predictor variables in a multiple linear regression analysis.

Coefficients					
Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	-4574	1783	-2.56	0.022	
Income	0.5104	0.0806	6.33	0.000	11.04
IQ	8.9	20.3	0.44	0.667	1.65
Age	0.0	56.1	0.00	1.000	2.24
Vacation	0.27	1.79	0.15	0.001	9.08

What is true about this analysis?

- The final model can be derived by multiplying the Coef column of data by each term
- The final model should only contain the terms Constant, Income and Vacation
- The predictor Age should be removed from the data and a new regression performed
- One of two correlated variables must be removed from the analysis

Thank you for taking this exam.

Correction model

1. 1 pt.1 pt.	C	9.	A
2. 1 pt.1 pt.	C	10.	D
3. 1 pt.1 pt.	C	11.	C
4. 1 pt.1 pt.	C	12.	A
5. 1 pt.1 pt.	B	13.	B
6. 1 pt.1 pt.	B	14.	D
7. 1 pt.1 pt.	C	15.	D
8. C 1 pt.			