



***The Lean Six Sigma Green Belt Examination***  
**Mock Exam V1.1**

**Multiple Choice**

**3 Hour Paper**

***The Lean Six Sigma Green Belt Examination  
Mock Exam V1.1***

**Instructions**

1. All 60 questions should be attempted.
2. All answers are to be marked on the answer grid provided.
3. Please use a pencil and NOT ink to mark your answers in the Answer sheet provided.
4. There is only one correct answer per question.
5. You have 3 hours for this paper.
6. You must get 38 or more correct to pass.

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**1 A study is to be carried out on a litter of puppies.**

**Information about the first puppy has been captured:**

<b>Color</b>	<b>Brown and Black</b>
<b>Coat</b>	<b>Long hair</b>
<b>Energy</b>	<b>High</b>
<b>Legs</b>	<b>4</b>
<b>Weight</b>	<b>15.5kg</b>
<b>Height</b>	<b>565mm</b>

**The analyst has stated that statistics on the appearance and personalities of the puppies cannot be measured, because this type of data cannot be counted or measured.**

**Is this statement correct?**

- a) No, because continuous data can be measured on a variable scale
- b) No, because qualitative data can be converted into discrete data
- c) Yes, because discrete data can only take certain values
- d) Yes, because qualitative data cannot be measured or counted

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- 2 Customers at the self-service checkouts of a supermarket must scan each purchase and put it in a bag in the 'bagging area'. Often the customers receive the error message 'please put the item in the bag', because they cannot open the plastic bags quickly enough.**

**In the DMAIC roadmap, which of the following is determined before the Define phase Gate Review?**

1. The customer's experience when opening a plastic bag takes longer than the checkout allows
2. Which parts of the scanning, bagging and weighing process are involved
3. The average time to open a bag; the average time taken for the error message to appear
4. Who has the most influence out of the customer, bag supplier and software supplier

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

- 3 A farmer is seeking ways to improve the farm's existing process for feeding cattle, so gathers information to create a SIPOC diagram.**

**Which of the following entries and reasons are appropriate on a SIPOC diagram?**

1. 'Feed storage container', because this affects the quality of the feed
2. 'Collect feed and fill troughs', because this is part of the process
3. 'Cattle fertilized field' , because this is an output of the process
4. 'Fed cattle', because these are an input to the process

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

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**4 According to the KANO model, which performance feature of a product or service is MOST likely to satisfy a customer's expectations?**

- a) Compliance to industry standards
- b) Financial performance of production process
- c) Delightfully friendly sales assistant
- d) Reliability and robustness of the components

**5 An egg distributor wants to monitor the number of eggs damaged or broken in transit. Each crate holds 288 eggs. Each shipment contains a different number of crates.**

**The number of eggs broken in transit has been counted. Because of the different size of each shipment, the control limits vary. On average 1 broken egg was found in each shipment.**

**What type of chart would be appropriate to capture this information?**

- a) C chart
- b) U chart
- c) I-MR chart
- d) NP chart

**6 A pharmaceutical company has recently removed a number of surplus items from a laboratory, clearing some much-needed space. Keen to utilize this new space, technicians have begun to store various materials in this area. Three separate employees have since been taken ill due to contaminated surfaces.**

**Which step in the 5S technique would determine where each item should be stored?**

- a) Standardize
- b) Shine
- c) Sustain
- d) Straighten

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**7** After returning from a two-week vacation a manager reviewed the Xbar and R charts that were maintained during the manager's absence. One of the Xbar charts shows the last 50 points to be very near the centre line. In fact, they all seem to be within about one sigma of the centre line.

**What is the BEST explanation for this occurrence?**

- a) Somebody restored the original, wider control limit calculation
- b) The process standard deviation has decreased and the control limits were not recomputed
- c) There has been poor quality performance for quite some time
- d) It shows that the operators did a very good job keeping the process close to target

**8** Which risk rating from a Failure Modes and Effects Analysis (FMEA) indicates the need to develop actions to reduce the 'potential effect(s) of failure'?

- a) Severity
- b) Occurrence
- c) Classification
- d) Detection

**9** Which is NOT a perspective described by the Balanced Scorecard (BSC) to develop metrics, collect data and analyze it?

- a) Individual and corporate self-improvement
- b) Internal and external customer satisfaction
- c) Expected return on investment
- d) Commercial and market sensitivity

**10** Why might a project team conduct a 'stakeholder analysis'?

- a) Identify the roles on a project for employees
- b) Organize work to ensure that necessary tasks are completed
- c) Provide a clear description of a process planning or improvement opportunity
- d) Develop a communications strategy to keep people informed

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**11 A production manager has asked a member of the production team to present a summary of the team's performance over the past three months.**

**The data presented was clear and concise, and delivered in a professional manner. However, the data showed the team's performance to be lower than expected, and that one member in particular had failed to meet several of the performance targets set.**

**Which response from the production manager would NOT be appropriate?**

- a) Publicly compliment the presenter on their format, content and delivery
- b) Openly discuss and share errors in individual performance
- c) Explain the danger to the business of missing the performance targets
- d) Tell the team they're smart and capable, and that's why more is expected of them

**12 A scaffolding company is replacing its existing steel bracketed scaffold system with a new 'Snapit' system. They want their new system to be light and easy to transport, and yet be as strong as the old system. They would like to reduce the time it takes to erect and dismantle the scaffold towers on site, and yet maintain the same level of stability as the old system.**

**How should the safety requirement be captured for the external Critical to Quality (CTQ)?**

- a) No accidents recorded as a result of the new 'Snapit' system
- b) Scaffold towers need to be safe when used within specification
- c) Scaffold towers should not collapse or fall over
- d) New system should survive a test bearing 150% of the specified load

**13 Which feature is NOT shared by both Lean and Six Sigma?**

- a) Focus on continuous improvement
- b) Commitment from top management
- c) Focus on customer satisfaction
- d) Long learning curve

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**14 A process produces the following statistics:**

Step	Scrap	Rework	Out
<b>A</b>	<b>6</b>	<b>4</b>	<b>80</b>
<b>B</b>	<b>6</b>	<b>2</b>	<b>90</b>
<b>C</b>	<b>5</b>	<b>2</b>	<b>75</b>
<b>Total</b>	<b>17</b>	<b>8</b>	<b>245</b>

**What is the Rolled Throughput Yield (RTY) for this process?**

- a) 74%
- b) 85%
- c) 92%
- d) 93%

**15 An engineer samples 100 parts from a production process. 20% defective parts are expected. The engineer plans to use the normal distribution to calculate a confidence interval for the mean proportion defectives.**

**Why is this choice allowed?**

- a) Central limit theorem allows it and  $np > 10$
- b) The sample size cannot be found in probability tables
- c) The proportion defectives is normal distributed
- d) Calculating a confidence interval is always based on the normal distribution

**16 Which attribute is required of all Lean Six Sigma team members?**

- a) Ability to manage people
- b) Statistical analysis experience
- c) Full time commitment
- d) Active listening skills

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**17** A project team at a Pizzeria restaurant must create a current-state value stream map to improve their pizza-making process. The project leader has gathered a team that includes the wait staff, kitchen staff and management to ensure that everyone who is involved in the process is represented. The team create a high-level map of the process by gathering information about each step, including activities, cycle times, defects and inventory; some of which are given in the table below.

The scope of the pizza-making process value stream is from the time the customer places an order to the time that the pizza is delivered to the customer's table (in minutes).

	Cycle Time	Value-added Cycle Time
Wait staff take order	2.00	0.50
Walk order to kitchen	2.00	0.00
Make dough, add sauce	1.25	1.00
Pass base to topping area	2.00	0.00
Add cheese and toppings	0.75	0.50
Move to oven	4.00	1.50
Cook pizza	6.00	6.00
Deliver to table	2.00	0.50
Totals	20.00	10.00

**Which action would reduce the Cycle Time?**

- a) Introduce an electronic flow of information between wait staff and kitchen
- b) Install a conveyor pizza oven to create a first in, first out (FIFO) lane
- c) Create a supermarket supply of ready-made pizza bases
- d) Implement a Kanban system to ensure the right number of pizza bases are created

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**18** A two-stage brainstorm session is being facilitated with a group of production line staff to identify potential reasons for a continued increase in the number of defects from a production line.

**What actions should be taken to support brainstorming techniques?**

1. Invite the production manager to lead the discussion
2. Ask staff to note their suspected reasons individually
3. Sort reasons into common groups and expand ideas
4. Highlight those reasons that need further investigation

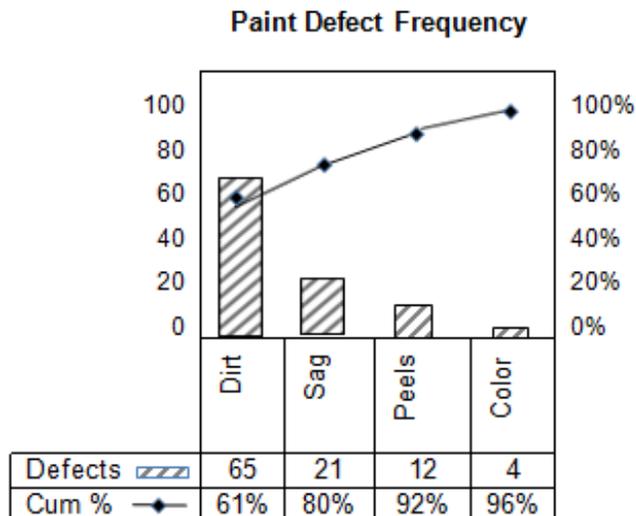
- a) 1, 2, 3
- b) 1, 2, 4
- c) 1, 3, 4
- d) 2, 3, 4

**19** What is the Range (R) of the data set: 2, 5, 6, 9, 8, 5, 7?

- a) 7
- b) 5
- c) 1
- d) 6

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**20** 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

**21** What is the name of the Six Sigma roadmap that is used for design rather than improving the manufacturing of a product?

- a) MSA
- b) DMAIC
- c) DMADV
- d) DOE

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**22 If the current operational availability of an automated assembly machine is not enough to meet an increase in customer demand, what is the BEST way to improve the machine's availability?**

- a) Maximize the speed of the machine
- b) Increase the number of operators
- c) Reduce breakdowns and delays
- d) Hire specialist maintenance personnel

**23 A hypermarket needs to link the products it displays on the shelves to the inventory in the warehouse and then to the supplier. The following steps have been introduced:**

- 1. The person responsible for the products on a shelf will place a flag on the top of the shelf when the shelf needs to be replenished**
- 2. The person in the warehouse will recognize this flag and will send some products to be displayed**
- 3. The person in the warehouse will update the warehouse data system with this withdrawal**
- 4. The data system will send an order to the supplier for more products**

**Which step needs to be added to make this process a Kanban system?**

- a) The data system will compare the remaining amount of products to the critical ordering point
- b) Stock levels will be increased to ensure surplus products are always available
- c) Additional warehouse space will be made available to store products
- d) The warehouse person will forecast how many products are required to fill the shelf

**24 Which is a purpose of the Eight Disciplines (8D) Problem Solving method?**

- a) Champions change
- b) Challenges standards
- c) Creates contingency
- d) Communicates progress

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**25 The influence of alcohol and sleeping pills on a motorist driving a car is to be tested, specifically the braking distance. Which of the following can be assessed using the One- Factor-At-a-Time approach?**

- 1. Normal braking distance when sober**
- 2. Consequence of drinking a large volume of alcohol**
- 3. Effect of several sleeping pills have on reaction time**
- 4. Effect of both alcohol and sleeping pills combined**

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

**26 Which of the three generic competitive strategies is evident in an organization that is performance driven, based on teamwork and welcomes change?**

- a) Customer Intimacy
- b) Operational Excellence
- c) Product Leadership
- d) Continuous Improvement

**27 When comparing a short-term process capability index  $C_p$  to a long-term process performance index  $P_{pk}$ , what should the result be?**

- a) Difference between  $P_{pk}$  and  $C_p$  is always 1.5 standard deviations
- b) Process capability  $C_p$  is a lower number than  $P_{pk}$
- c) Process performance  $P_{pk}$  is a lower number than  $C_p$
- d) Process capability  $C_p$  and process performance  $P_{pk}$  are virtually identical

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**28** 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 57 minutes
<b>Availability Rate</b>	91.54%
Ideal production rate:	44 items / minutes
Items produced during shift	14,300
<b>Performance Rate</b>	91.04%
Number of defects	610
<b>Quality Rate</b>	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

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**29** 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:

Need	Quality Driver	Critical to Quality (Ext)
Good Customer Satisfaction	Price	-Range £2.00-£3.50
	Coffee on offer	-Range offering choice -Tasty coffee -Fresh, no older than 5 minutes
	Staff	-Good pleasant staff -Prompt service < 5 minutes
	Surroundings	-Pleasant ambience -Clean and hygienic

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

- a) No, because the price should be a single fee rather than a range
- b) No, because 'pleasant' and 'tasty' are subjective and need further definition
- c) Yes, because the quality drivers cover a wide range of factors
- d) Yes, because this diagram should identify the factors of influence

**30** Which of the following describe elements of metrology?

1. Process of checking the accuracy of a measurement device
2. Adjusting an instrument to make sure it is within specification
3. Scientific study of the atmosphere and how it evolves through time
4. Ability to relate measurement to a reference standard in a way that is verifiable

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

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**31** A manufacturing company is replacing an existing horizontal saw with two new vertical cutting saws. These saws will guarantee accuracies to 0.0005", making it easier to accurately cut large panels into smaller size pieces whilst taking up less floor space.

At the early stages of the DMAIC project, in every customer focus group, customer interview and customer survey, the Voice of the Customer (VOC) specified the need for 'safety'.

The Process Failure Modes and Effects Analysis (FMEA) reviewed a number of potential safety issues and scored each of these with a relatively high Risk Priority Number (RPN).

The project leader has developed a Control plan to inspect and monitor process performance in detail, but this does not include any measures for safety.

Should this Control plan be implemented?

- a) No, because new processes should NOT have potential failures
- b) No, because this plan should contain actions to prevent or detect all potential failures
- c) Yes, because the project leader is better informed than the customer
- d) Yes, because safety is NOT a critical to quality requirement

**32** 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

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**33 Phillips & Company manufacture screwdrivers.**

**After thorough market research, they determine that customers would prefer rubber handles on their screwdrivers rather than plastic handles and would be prepared pay €1 more for such a feature.**

**To manufacture and ship the new handles there is an additional cost of €0.60 per unit. Is there any added value in changing the design to rubber handles?**

- a) No, because there is an additional cost of €0.60 to manufacture them
- b) No, because the rubber handles are NOT necessary for the product
- c) Yes, because the customers are willing to pay more for this feature
- d) Yes, because changing the design of a product adds value

**34 The goal of an experiment is to find the best way to microwave a bag of popcorn.**

**When a bag of popcorn is cooked in the microwave according to the instructions on the packet, most of the kernels pop, but some do not. The length of time the popcorn is in the microwave (between 3 and 5 minutes) and the power setting (between 5 and 10) seem to have an effect on the number of kernels popped. There are two brands of popcorn to choose from (A or B).**

**We know that popping corn for a long time on a high setting tends to scorch the kernels. Combined popping time (PT) and power settings (PS) are to be constrained ( $PT \times PS < 40$ )**

**Which factor is NOT considered a factor of influence in this experiment?**

- a) Cooking time (between 3 and 5 minutes)
- b) Power setting (between settings 5 and 10)
- c) Brand of popcorn (A or B)
- d) Combined power setting and cooking time ( $PT \times PS$ )

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**35 A Kaizen Blitz is being carried out in a small retail outlet.**

**What is the first action that should be taken by the facilitator?**

- a) Spend time gathering and analysing data
- b) Ask members of staff for their ideas
- c) Determine the solution and prepare a plan
- d) Prepare a problem statement and long term strategy

**36 The changeover process of a press is shown below:**

- 1. Run empty / stop production**
- 2. Remove Mould 'A' from the press**
- 3. Mould 'A' is cleaned and stored**
- 4. Mould 'B' is picked up from storage**
- 5. Adjusting Mould 'B' under the guidance of a mechanic specialist**
- 6. Mould 'B' is installed in the press**
- 7. Release production process by supervisor**
- 8. Start production**

**What activities should be eliminated or made 'external' in order to reduce the changeover time?**

- a) 3, 7, 8
- b) 4, 6, 7
- c) 3, 4, 5
- d) 3, 4, 7

**37 Who introduced the concept of 'Statistical Process Control' (SPC)?**

- a) Sir Ronald A. Fisher
- b) W. Edwards Deming
- c) Joseph M. Juran
- d) Walter A. Shewhart

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**38** 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
<b>Model</b>	<b>11</b>	<b>2802.20</b>	<b>254.75</b>	<b>58.65</b>	<b>0.000</b>
<b>Linear</b>	<b>4</b>	<b>2701.25</b>	<b>675.31</b>	<b>155.47</b>	<b>0.000</b>
<b>A</b>	<b>1</b>	<b>256.00</b>	<b>256.00</b>	<b>58.94</b>	<b>0.000</b>
<b>B</b>	<b>1</b>	<b>2304.00</b>	<b>2304.00</b>	<b>530.42</b>	<b>0.000</b>
<b>C</b>	<b>1</b>	<b>20.25</b>	<b>20.25</b>	<b>4.66</b>	<b>0.063</b>
<b>D</b>	<b>1</b>	<b>121.00</b>	<b>121.00</b>	<b>27.86</b>	<b>0.001</b>
<b>2-Way Interactions</b>	<b>6</b>	<b>93.75</b>	<b>15.62</b>	<b>3.60</b>	<b>0.049</b>
<b>A*B</b>	<b>1</b>	<b>4.00</b>	<b>4.00</b>	<b>0.92</b>	<b>0.365</b>
<b>A*C</b>	<b>1</b>	<b>2.25</b>	<b>2.25</b>	<b>0.52</b>	<b>0.492</b>
<b>A*D</b>	<b>1</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>1.000</b>
<b>B*C</b>	<b>1</b>	<b>6.25</b>	<b>6.25</b>	<b>1.44</b>	<b>0.265</b>
<b>B*D</b>	<b>1</b>	<b>81.00</b>	<b>81.00</b>	<b>18.65</b>	<b>0.003</b>
<b>C*D</b>	<b>1</b>	<b>0.25</b>	<b>0.25</b>	<b>0.06</b>	<b>0.816</b>
<b>Curvature</b>	<b>1</b>	<b>7.20</b>	<b>7.20</b>	<b>1.66</b>	<b>0.234</b>
<b>Error</b>	<b>8</b>	<b>34.75</b>	<b>4.34</b>		
<b>Lack-of-Fit</b>	<b>5</b>	<b>6.00</b>	<b>1.20</b>	<b>0.13</b>	<b>0.976</b>
<b>Pure Error</b>	<b>3</b>	<b>28.75</b>	<b>9.58</b>		
<b>Total</b>	<b>19</b>	<b>2836.95</b>			

**What can be concluded from the results table using a 5% significant level?**

- a) Main effects A and C are significant
- b) 3 main effects and the 2-way interaction B\*D are significant
- c) There is no significant main effect, just 2 way interactions B\*D and A\*C
- d) All response observations are unusual; no conclusions can be made from this experiment

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**39** An anti-virus software company (AVS) released a software update to all its customers. The software update contained an unidentified coding error. This error caused a healthy system file to be flagged as being malicious. Once the file was tagged as malicious, a built-in safety mechanism caused the system to reboot in an attempt to remove the malicious file. This caused the users to experience the ‘blue screen of death’ or an endless series of attempted reboots. Tens of thousands of users were impacted causing an estimated €50 million in lost productivity. It is unknown why the coding error occurred, but possible fault paths need to be examined. The AVS quality assurance process missed the coding error before going into production. There was no peer review of the software update completed before release. Both of these quality system failures require further examination. The following has been recorded in the table below:

<b>Symptom</b>	<b>Blue screen of death or continuous reboots</b>
<b>Effect</b>	<b>System reboots to remove file Why does the system reboot?</b>
<b>Failure</b>	<b>Healthy file tagged as malicious Why was a healthy file tagged as malicious?</b>
<b>Cause</b>	<b>Software was released with coding error Why was the error not detected?</b>
<b>Root Cause</b>	<b>No peer review before release Why was there no review?</b>

**Is this an appropriate application of the 5-Whys technique for this problem?**

- a) No, because the symptom should include the number of users impacted by the outcome
- b) No, because the symptom should be recorded as an estimated €50 million in lost productivity
- c) Yes, because the question of ‘Why’ was asked 5 times
- d) Yes, because the question of ‘Why the problem occurred’ has been answered

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**40** A team leader has been asked to do a Capability and Performance analysis on a process. Although the data collected from each rational subgroup is normally distributed the data from the process as a whole is clearly not distributed normally.

Which of the following tools might be used in this analysis?

1. Capability analysis for each sub-group based on normal distribution assumption
2. Use a Box-Cox transformation and then analyse the process data with the standard tool
3. Identify the distribution and use a method that is based on the non-normal distribution
4. Perform a Z-transformation then analyse the process data with the standard tool

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

**41** A courier company maintains statistics on all of its delivery routes. Past records show Route X takes between 10 and 15 minutes to deliver to, depending on variations in traffic. When checking the delivery records during the past week, the shift manager noticed that on Tuesday Route X took 34 minutes to complete delivery.

The shift manager has flagged this as a common cause variation and has proposed the use of bicycles, which can move more easily through traffic jams than the vehicles they currently use.

Is this a valid observation?

- a) No, because this is a special cause variation that should be investigated further
- b) No, because excessive traffic may have delayed the driver
- c) Yes, because performance is outside of the normal upper and lower limits
- d) Yes, because the overall process should be improved so that variation is reduced

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**42 Which is the use of a skill matrix?**

- a) Identify whether team members are carrying out their job efficiently
- b) Record the skills used, and skills wasted as a lesson for future projects
- c) Ensure different people can perform different steps in an operation
- d) Measure team member performance according to their levels of skill

**43 What statement describes a correlation analysis?**

- a) Can be solved by estimating the value of the dependent variable for various values of the independent variable
- b) Considers the joint variation of two continuous variables
- c) Is the one case where the underlying distributions must be hypergeometric
- d) Can be solved by assuming that the variables are normally and independently distributed with a mean=0 and variance= $s^2$

**44 Which of the following questions should be asked on the completion of a process improvement project?**

1. Should anything have been done differently?
2. What aspect of the project should be changed if doing it again?
3. What are the customer's requirements and expectations?
4. What were the weakest and strongest points?

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

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**45** Volume leveling has been applied to a manufacturing process. A single product is produced in three sequential steps:

**Step 1: 20 minutes Step 2: 30 minutes Step 3: 50 minutes**

**These steps are operating independently of each other. The manufacturer of this product has promised to supply a customer with 100 units in three weeks or 95 production hours.**

**What is the largest number of units that can be produced in this time?**

- a) 100
- b) 113
- c) 152
- d) 206

**46** A manufacturing company is introducing a new training program at a cost of €42,000. The company's existing training program cost €60,000 over the same period. The new, more efficient and effective training program is expected to deliver increased productivity, improve customer satisfaction, employee safety and morale and reduce absenteeism.

**Which of the following are soft benefits of the new training program?**

- 1. Employees feeling safer**
- 2. Cost savings of €18,000**
- 3. Greater customer satisfaction**
- 4. Higher employee morale**

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

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**47 Consider an investigation among 10 households on their spending behavior regarding food as a function of their income.**

**Regression Analysis: weekly food spending versus income**

**Analysis of Variance**

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Regression	1	275.8	275.82	5.75	0.043
Income	1	275.8	275.82	5.75	0.043
Error	8	383.8	47.97		
Lack-of-Fit	6	234.8	39.13	0.53	0.771
Pure Error	2	149.0	74.50		
Total	9	659.6			

**Model Summary**

S	R-sq	R-sq	R-sq
6.92623	41.82%	34.54%	15.19%

**Coefficients**

Term	Coef	SE	T-	P-
Consta	1.2	72.2	0.02	0.987
Income	0.048	0.0202	2.40	0.043

**Regression Equation**

**Weekly food spending = 1.2 + 0.0484 income**

**Which observation is appropriate for this data set?**

- a) The relation is significant but R-sq is too low for useful model
- b) The relation is significant and R-sq is acceptable for a useful model
- c) The relation is not significant and R-sq is too low for a useful model
- d) The relation is not significant in spite of R-sq being acceptable for a useful model

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**48** A micro-brewery, working to the 'Just In Time' (JIT) principle, has received an order for 50 crates of beer. Each crate contains 24 x 30cl bottles (0.3 litres). With only one brewing kettle operational, the brewery can produce up to 100 litres of beer each day.

The manager of the brewery has promised to deliver the order in three days. Is this a realistic Lead-Time for this order?

- a) No, because this order will take more than three days to produce
- b) No, because this order will take more than five days to produce
- c) Yes, because there should be finished crates in stock
- d) Yes, because this order can be produced in three days

**49** Which activity will increase the ongoing overall costs of production?

- a) Centring the process mean
- b) Reducing process variation
- c) Preventing delivery of defective products
- d) Identifying the root cause of errors

**50** A manufacturing plant has a number of inspections built into its production process. Many of these inspections are required for to comply with health and safety regulations, some are for control purposes and two are inspections that have been mandated by the customer.

Should any of these inspections be classed as the 'Over-processing' type of 'Waste' (Muda)?

- a) No, because the mandated inspections are classed as a necessary activity
- b) No, because all inspections are classed as value-adding
- c) Yes, because the inspections measuring quality do NOT change the product
- d) Yes, because the inspections mandated by a customer are unnecessary movement

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**51 A process owner wants to know if he can reduce the mean of the process by at least 20%, by using a different base material.**

**In the old process the mean is 30 and the standard deviation is 5.**

**How large a sample must be taken from the new process to test whether there has been a difference with a confidence of 95% and a power of 90%?**

- a) 6
- b) 9
- c) 13
- d) 16

**52 Which characteristic of a company is MOST likely to influence the success of a Lean Six Sigma project?**

- a) Organizational culture
- b) Financial security
- c) Geographic location
- d) Market sector

**53 An inspector assesses a batch of products.**

**Which action would represent a Type I Error?**

- a) Reject the batch as defective when there are defects in the batch
- b) Approve the batch as conforming when it has no defects
- c) Approve the batch as conforming when the batch actually has defects
- d) Reject the batch as defective when there are no defects

**54 Which role is responsible for approving completed projects?**

- a) Lean Facilitator
- b) Master Black Belt
- c) Coach
- d) Champion

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**55** The following 10 measurements were provided by an appraiser.

The True Value is 0.80mm.

<b>1 = 0.75</b>	<b>6 = 0.80</b>
<b>2 = 0.75</b>	<b>7 = 0.75</b>
<b>3 = 0.80</b>	<b>8 = 0.75</b>
<b>4 = 0.80</b>	<b>9 = 0.75</b>
<b>5 = 0.65</b>	<b>10 = 0.70</b>

**What is the Bias measurement in this system?**

- a) - 0.05
- b) 0.05
- c) 12.50
- d) 13.33

**56** A project is currently in week 9 of implementation. On the project's Gantt chart the delivery of some materials by a supplier is planned in week 10. If this delivery is not received by week 15 the project will be delivered late. The supplier has promised that these materials should arrive by week 13.

**What is the 'total float' on the baseline delivery of these materials?**

- a) 3 weeks
- b) 2 weeks
- c) 5 weeks
- d) 6 weeks

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**57 Which of the following can be answered using a Binomial distribution?**

- 1. Probability that a ball in a roulette wheel will land on '0' twice out of 10 spins**
- 2. Likelihood that a piece of toast will land butter side down three times if dropped 10 times**
- 3. With 10 attempts, the chance of drawing the '5' of hearts from a deck of cards twice**
- 4. Number of times a dealer deals cards totalling '21' in any 10 hours**

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

**58 The director of a laboratory has conducted a risk assessment for hazards and in response to the findings has selected appropriate Personal Protective Equipment (PPE) which has been provided to the employees. The use of PPE is to be described in a procedure to be produced by the laboratory employees and enforced by the laboratory supervisor.**

**Which entry is LEAST appropriate for the 'Standard Operating Procedure' (SOP)?**

- a) Safety glasses must meet the requirements of ANSI Z87.1 (latest edition)
- b) Employees using PPE must be trained in proper selection, care and use
- c) Laboratory supervisor to evaluate and update the use of PPE on a quarterly basis
- d) Eye protection equipment is available in the PPE cabinet and is personally-assigned

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**59** The current state Value Stream Map for process 'X' consists of three sequential steps:

Process Steps	A	B	C
Cycle Time (minutes)	4	5	9
Yield (%)	80	100	90
Work In Progress (WIP) (pieces)	20	12	50

On a future state Value Stream Map, to reduce Mura (unevenness), Process X is to be shown as a one-piece flow process.

What will be the average Lead-Time for one good piece?

- a) 18 minutes
- b) 20 minutes
- c) 590 minutes
- d) 660 minutes

**60** As a result of its recent marketing campaign, a manufacturing company has experienced a huge increase in customer orders. A trend that looks set to continue.

In the rush to meet this increased demand, the production manager hired a number of additional staff, to help support the existing process. However, the operating capacity of the existing equipment in the process is inconsistent. Sometimes it runs without fault, other times it slows down and speeds up without warning. A review of the process has not been carried out because the production manager considers the problem to have a simple fix - demand is greater than the existing equipment can supply.

Therefore, on the recommendation of the production manager, the company has decided to purchase and install additional production equipment to increase its capacity and reduce Lead Times.

Which of the following reasons explain why the scope of the project should include Lean Six Sigma process improvement work?

1. It has a strong focus on reducing variation
2. Reasons for an instable or unpredictable process are identified
3. It is suitable for implementing known solutions
4. Both process capability and performance are reported

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

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