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SCM 301 (Lutz) – Exam 3 – Practice Exam Solutions

1. **C –** Constant competition

2. **D –** Value perspective

3. **D –** All of the above

4. **A –** Conformance perspective

5. **A –** 0.32

   The mean of 198 is centered in the LTL and the UTL. We know that the mean is centered because the UTL of 211 plus the LTL of 198 divided by 2 is equal to the mean of 198.

   Since the mean is centered, we can use the process capability ratio (C_p):

$$C_p = \frac{UTL - LTL}{6\sigma}$$

$$\frac{211-185}{6*(13.5)} = \frac{26}{81} = 0.32$$

6. **B –** Less than or equal to 2.17 pounds

   Six Sigma quality – A level of quality that indicates that a process is well controlled

   - **To achieve Six Sigma quality –** Reduce the variability of a process to such a point that the process capability is <u>greater than or equal to 2</u>

$$C_p = \frac{UTL - LTL}{6\sigma} \geq 2 \quad \longrightarrow \quad UTL - LTL \geq 12\sigma$$

$211 - 185 \geq 12\sigma$

$26 \geq 12\sigma$

$\sigma \leq \frac{26}{12}$

$\sigma \leq 2.167 = 2.17$

7. **D –** Total quality management (TQM)

8. **B –** Conformance

9. **A –** Attributes

10. **B –** Cost

11. **A –** 0.67

$UTL = 40 + 1 = 41$
$LTL = 40 - 1 = 39$
$\sigma = 0.50$

$$C_p = \frac{UTL - LTL}{6\sigma}$$

$= \frac{41 - 39}{6 * (0.50)} = \frac{2}{3} = 0.67$

12. **B –** No

The process capability ratio is <u>not</u> ≥ 1

13. **A –** 0.015

Based on the information given in the problem, the variable type that we are dealing with is <u>attributes</u>. Therefore, we are going to be using a p-chart.

$\bar{p} = 0.12$

$$\hat{\sigma} = \sqrt{\frac{\bar{p}(1-\bar{p})}{n}}$$

$= \sqrt{\frac{0.12(1-0.12)}{450}} = \sqrt{\frac{0.12(.88)}{450}} = 0.01531$ = 0.015

14. **B –** 0.165

$UCL = \bar{p} + 3\hat{\sigma}$
$UCL = 0.12 + 3(0.015)$
$UCL = 0.12 + 0.045 = 0.165$

15. **C –** 0.075

$LCL = \bar{p} - 3\hat{\sigma}$
$LCL = 0.12 - 3(0.015)$
$LCL = 0.12 - 0.045 = 0.075$

16. **D –** Process capability index

17. **A –** True

18. **C –** 0.061

$$\overline{p} = \frac{\sum_{j=1}^{m} p_j}{m}$$

$$\bar{p} = \frac{(6+7+1+4+2+10+6+3+2+2)}{(70*10)} = \frac{43}{700} = 0.061$$

19. **D –** 0.147

$$\hat{\sigma} = \sqrt{\frac{\overline{p}(1-\overline{p})}{n}}$$

$$= \sqrt{\frac{0.061(1-0.061)}{70}} = \sqrt{\frac{0.061(0.939)}{70}} = 0.0286$$

$$UCL = \bar{p} + 3\hat{\sigma}$$
$$UCL = 0.061 + 3(0.0286)$$
$$UCL = 0.061 + 0.0858 = 0.1468 = 0.147$$

20. **B –** 0

$$LCL = 0.061 - 3\hat{\sigma}$$
$$UCL = 0.061 + 3(0.0286)$$
$$UCL = 0.061 - 0.0858 = -0.0248 = 0$$

Remember, if your LCL is a negative value, set it to 0!

21. **D –** Reliability

22. **A –** 0.50

$$C_{pk} = \min\left[\frac{\mu - LTL}{3\sigma}, \frac{UTL - \mu}{3\sigma}\right]$$

LTL = 20 – 0.9 = 19.1
UTL = 20 + 0.9 = 20.9

$$= min\left[\frac{20.3 - 19.1}{3 * (0.4)}\right], \left[\frac{20.9 - 20.3}{3 * (0.4)}\right]$$

$$= min\left[\frac{1.2}{1.2}\right], \left[\frac{0.6}{1.2}\right]$$

$$= min[1\ , 0.5] = 0.50$$

<u>Use the Following Work for the Next Two Problems</u>

$$\overline{\overline{X}} = \frac{\sum_{j=1}^{m} \overline{X}_j}{m}$$

$$\bar{\bar{X}} = \frac{(13.2 + 13.3 + 14.1 + 12.6 + 12.2)}{5} = \frac{65.4}{5} = 13.08$$

$$\overline{R} = \frac{\sum_{j=1}^{m} R_j}{m}$$

$$\bar{R} = \frac{(1.3 + 1.3 + 2.3 + 1.3 + 0.9)}{5} = \frac{7.1}{5} = 1.42$$

Sample size (n) = 7
$A_2 = 0.42$
$D_3 = 0.08$
$D_4 = 1.92$

23. **A –** 2.7264; 0.1136

$$UCL\ (R - chart) = D_4\bar{R}$$
$$UCL\ (R - chart) = (1.92)(1.42) = 2.7264$$

$$LCL\ (R - chart) = D_3\bar{R}$$
$$LCL\ (R - chart) = (0.08)(1.42) = 0.1136$$

24. **C –** 13.6764; 12.4836

$$UCL\ (x - bar) = \bar{\bar{X}} + A_2\bar{R}$$
$$UCL = 13.08 + (0.42)(1.42)$$
$$UCL = 13.08 + 0.5964 = 13.6764$$

$$LCL\ (x - bar) = \bar{\bar{X}} - A_2\bar{R}$$
$$UCL = 13.08 - (0.42)(1.42)$$
$$UCL = 13.08 - 0.5964 = 12.4836$$

25. **A –** Internal failure costs

26. **A –** X-bar chart

27. **A –** Internal failure costs

28. **B –** The consumer's risk

29. **C –** Serviceability

30. **D –** External failure costs

31. **A –** Continuous improvement

32. **B –** Appraisal

33. **A –** True

34. **A –** True

35. **B –** 0.40

Since the process mean (μ) <u>is not</u> exactly centered on the target value, we need to use the process capability index instead of the process capability ratio. The formula for the process capability index is:

$$C_{pk} = \min\left[\frac{\mu - LTL}{3\sigma}, \frac{UTL - \mu}{3\sigma}\right]$$

We are looking for the standard deviation that would give us a process capability index of 1.5. Based on the information given, we can find the LTL and UTL:

LTL = 160 – 2 = 158
UTL = 160 + 2 = 162

Now, we can plug the information that we have into the C_{pk} formula:

$$1.5 = \min\left[\frac{160.2 - 158}{3\sigma}, \frac{162 - 160.2}{3\sigma}\right]$$

$$1.5 = \min\left[\frac{2.2}{3\sigma}, \frac{1.8}{3\sigma}\right]$$

We want to use the second fraction inside of the brackets to move forward since it is smaller. We always want to use whichever fraction is smaller inside of the brackets when solving for C_{pk}. Then, we can use algebra to get σ by itself.

$$1.5 = \frac{1.8}{3\sigma}$$

$$4.5\sigma = 1.8$$

$$\sigma = \frac{1.8}{4.5} = 0.40$$

36. **C –** 0.44

Since the process mean (μ) is exactly centered on the target value, we need to use the process capability ratio instead of the process capability index. The formula for the process capability ratio is:

$$C_p = \frac{UTL - LTL}{6\sigma}$$

We are looking for the standard deviation that would give us a process capability ratio of 1.5. Based on the information given, we can find the LTL and UTL:

LTL = 160 – 2 = 158
UTL = 160 + 2 = 162

Now, we can plug the information that we have into the C_p formula:

$$1.5 = \frac{162 - 158}{6\sigma}$$

$$9\sigma = 4$$

$$\sigma = \frac{4}{9} = 0.4444$$

37. **D –** All of the above

38. **A –** The information they receive is more distorted than companies located downstream

39. **C –** 70,000 ounces

Since demand is constant and there is no variability in lead time, we can use the following formula to calculate the reorder point (ROP):

$$\boldsymbol{ROP\ (with\ certianty) = d \times L}$$

= (10,000)*(7) = 70,000 ounces

40. **D –** Anticipation stock

41. **A –** More distorted the information is that they receive

42. **D –** A and C

Annual demand (D) is determined by a company's customers and is outside of a supply chain manager's control

43. **C –** 191

$$\boldsymbol{Economic\ Order\ Quantity\ (EOQ) = \sqrt{\frac{2SD}{H}}}$$

$$(EOQ) = \sqrt{\frac{2(16)(670)}{3}} = 84.54 = 85$$

$$\boldsymbol{Adjusted\ Total\ Annual\ Inventory\ Cost\ (TAC) = H\left(\frac{Q}{2}\right) + S\left(\frac{D}{Q}\right) + DP}$$

$$(TAC)\ at\ 85\ = 3\left(\frac{85}{2}\right) + 16\left(\frac{670}{85}\right) + (670 * 10.50)$$
$$(TAC)\ at\ 85\ = 127.5 + 126.12 + 7{,}035 = 7{,}288.62$$

$$(TAC)\ at\ 191\ = 3\left(\frac{191}{2}\right) + 16\left(\frac{670}{191}\right) + (670 * 7.25)$$
$$(TAC)\ at\ 191\ = 286.50 + 56.13 + 4{,}857.50 = 5{,}200.13$$

Since the total cost for ordering 191 units is less than the total cost for ordering 85 units, the company should order 191 units at a time to take advantage of the price discount.

44. **A –** 72,074

$$ROP = \overline{dL} + z\sqrt{\overline{L}\sigma_d^2 + \overline{d}^2\sigma_L^2}$$

$$(10{,}000)(7) + 1.65\sqrt{(7)(475)^2 + (10{,}000)^2(0)^0}$$
$$70{,}000 + 1.65\sqrt{1{,}579{,}375}$$
$$70{,}000 + 1.65(1{,}256.73)$$
$$70{,}000 + 2{,}073.61 = 72{,}073.61 = 72{,}074$$

45. **C –** 103,066

$$ROP = \overline{dL} + z\sqrt{\overline{L}\sigma_d^2 + \overline{d}^2\sigma_L^2}$$

$(10{,}000)(7) + 1.65\sqrt{(7)(475)^2 + (10{,}000)^2(2)^2}$
$70{,}000 + 1.65\sqrt{401{,}579{,}375}$
$70{,}000 + 1.65(20{,}039.45)$
$70{,}000 + (33{,}065.08) = 103{,}065.09 = 103{,}066$

46. **C –** An increase in the standard deviation of demand will reduce the amount of safety stock that a company needs to hold

C is false because an increase in the standard deviation of demand will increase, not reduce, the amount of safety stock that a company needs to hold.

47. **D –** Manufacturing plant

48. **B –** The flexibility of inventory increases as materials move down the supply chain

49. **A –** 253

$$\boldsymbol{Economic\ Order\ Quantity\ (EOQ)} = \sqrt{\frac{\boldsymbol{2SD}}{\boldsymbol{H}}}$$

$$= \sqrt{\frac{(2)(\$400)(2{,}400)}{\$30}} = \sqrt{64{,}000} = 252.98 = 253$$

50. **A –** 127

$$\boldsymbol{Average\ Inventory} = \left(\frac{\boldsymbol{Q}}{\boldsymbol{2}}\right) = \left(\frac{253}{2}\right) = 126.5 = 127$$

51. **A –** 10

$$\boldsymbol{Avg\ \#\ orders\ per\ yr} = \frac{\boldsymbol{D}}{\boldsymbol{Q}} = \frac{2{,}400}{253} = 9.486 = 9.49 = 1$$

52. **A –** $3,794.47

$$\boldsymbol{Total\ Ordering\ Cost\ (TOC)} = \boldsymbol{S} \times \left(\frac{\boldsymbol{D}}{\boldsymbol{Q}}\right) = \$400 \times \left(\frac{2{,}400}{253}\right) = \$3{,}794.47$$

53. **B –** $3,795

$$\boldsymbol{Total\ Holding\ Cost\ (THC) = H\ \times \left(\frac{Q}{2}\right)} = \$30\ \times \left(\frac{253}{2}\right) = \$3{,}795$$

54. **C –** $7,589.47

$$\boldsymbol{Total\ Annual\ Inventory\ (TAC) Cost\ = H\left(\frac{Q}{2}\right) +\ S\left(\frac{D}{Q}\right)}$$

= $3,795 + $3,794.47 = $7,589.47

55. **E –** All of the above

56. **A –** Periodic review system

57. **B –** Safety stock

58. **C –** Transportation stock

59. **A –** Economic order quantity

60. **B –** Dependent

61. **D –** 435 shirts

$$ROP = (40) * (7) + 1.28\sqrt{(7)(5)^2 + (40)^2(3)^2}$$

$$ROP = 280 + 1.28(120.73)$$

$$ROP = 280 + 154.53 = 434.53 = 435$$

62. **B –** 292

D = (190 units/week)(52 weeks) = 9,880
S = $90
H = ($420)(0.05) = $21

$$\boldsymbol{Economic\ Order\ Quantity\ (EOQ) = \sqrt{\frac{2SD}{H}}}$$

$$(EOQ) = \sqrt{\frac{(2)(90)(9{,}880)}{21}} = 291.0081 = 292$$

63. **D –** $6,111.21

$$\boldsymbol{Total\ Holding\ and\ Ordering\ Costs\ (TAC) = H\left(\frac{Q}{2}\right) + S\left(\frac{D}{Q}\right)}$$

$$(TAC) = 21\left(\frac{292}{2}\right) + 90\left(\frac{9{,}880}{292}\right)$$

$$(TAC) = 3{,}066 + 3{,}045.21 = \$6{,}111.21$$

64. **E –** 244

$$SS = z\sqrt{\overline{L}\sigma_d^2 + \overline{d}^2\sigma_L^2}$$

$$SS = 1.28\sqrt{(2)(3)^2 + (190)^2(1)^2}$$
$$SS = 1.28\sqrt{18 + 36{,}100}$$
$$SS = 1.28(190.05) = 243.264 = 244$$

65. **A –** 624

$$\boldsymbol{ROP = \overline{dL} + SS}$$
ROP = (190)(2) + 244
ROP = 380 + 244 = 624

66. **A –** Continuous review system

67. **D –** An automaker purchases four tires for each automobile that they produce\

68. **D –** Periodic review system

69. **A –** 157

$$\boldsymbol{R = \mu_{RP+L} + z\sigma_{RP+L}}$$
$$R = 140 + (1.28)(13)$$
$$R = 140 + 16.64 = 156.64 = 157$$

70. **B –** 162

$$\boldsymbol{R = \mu_{RP+L} + z\sigma_{RP+L}}$$
$$R = 140 + (1.65)(13)$$
$$R = 140 + 21.45 = 161.45 = 162$$

71. **C –** 122

$$\boldsymbol{Q = R - I}$$
$$Q = 157 - 35 = 122$$

<u>Use the Following Work for the Next Four Problems</u>

<u>Supplier 1</u>

Cost per unit = $260 + $9 + ($1,100 / 3,600 units)
Cost per unit = $260 + $9 + $0.31 = $269.31 per unit
Cost per month = [($260 + $9)*3,600] + $1,100 = $969,500

<u>Supplier 2</u>

Cost per unit = $150 + $5 + [($7,600 + $1,100) / 3,600 units)
Cost per unit = $150 + $5 + $2.42 = $157.42 per unit
Cost per month = [($150 + $5)*3,600] + $7,600 + $1,100 = $566,700

<u>Supplier 3</u>

Cost per unit = $196 + $9 + [($9,600 + $1,500) / 3,600 units)
Cost per unit = $196 + $9 + $3.08 = $208.08 per unit
Cost per month = [($196 + $9)*3,600] + $9,600 + $1,500 = $749,100

72. **A –** Make-to-stock (MTS) product

73. **D –** Product-based layout

74. **D –** Engineer-to-order (ETO) product

75. **E –** Only A and B

76. **A –** Make-to-stock (MTS) product

77. **D –** Job shop

78. **C –** Batch manufacturing

79. **E –** Production line

80. **D –** Flexible manufacturing system (FMS)

81. **B –** Batch manufacturing

82. **D –** Activities that take place after the point of customization are called upstream activities

83. **D –** All of the above

84. **A –** Machines and workers are brought to the job

85. **C –** The front room

86. **C –** Product quality will be higher

87. **A –** Back room

88. **C –** Fixed-position

89. **D –** All of the above

90. **A –** Capital expenditures

91. **B –** The variable cost per unit is low when producing at high volumes on a production line

92. **B – 26**

$$y = \frac{DT(1+x)}{C}$$

$$y = \frac{(1{,}500)(45/60)(1.15)}{50} = \frac{1{,}293.75}{50} = 25.875 = 26$$

93. **D –** All of the above

94. **A –** True

95. **A –** The firm's supply chain will be more vulnerable to supply disruptions

96. **A –** True

97. **C –** The end customers

98. **E –** B and C

99. **D –** Increase in product quality

100. **C –** Waiting

101. **C –** Lean supply chain management

102. **D –** In a single-card Kanban system, the single card is the production card

103. **A –** Move card; production card

104. **A –** A pull system is a production system in which actual downstream demand sets off a chain of events that pull materials through the various steps of the production process

105. **A –** True

106. **C –** Demand responsive

107. **C –** 100

$$\boldsymbol{y = \frac{DT(1 + x)}{C}}$$

$$y = \frac{(160)(48)(1.30)}{100} = \frac{9{,}984}{100} = 99.84 = 100$$

108. **D –** Defects

109. **D –** Unnecessary inventory

110. **A –** True

111. **B –** The term just-in-time (JIT) production is used interchangeably with the term Lean production

112. **A –** Waste

113. **A –** True

114. **D –** Increasing inventory

115. **A –** True

116. **A –** True