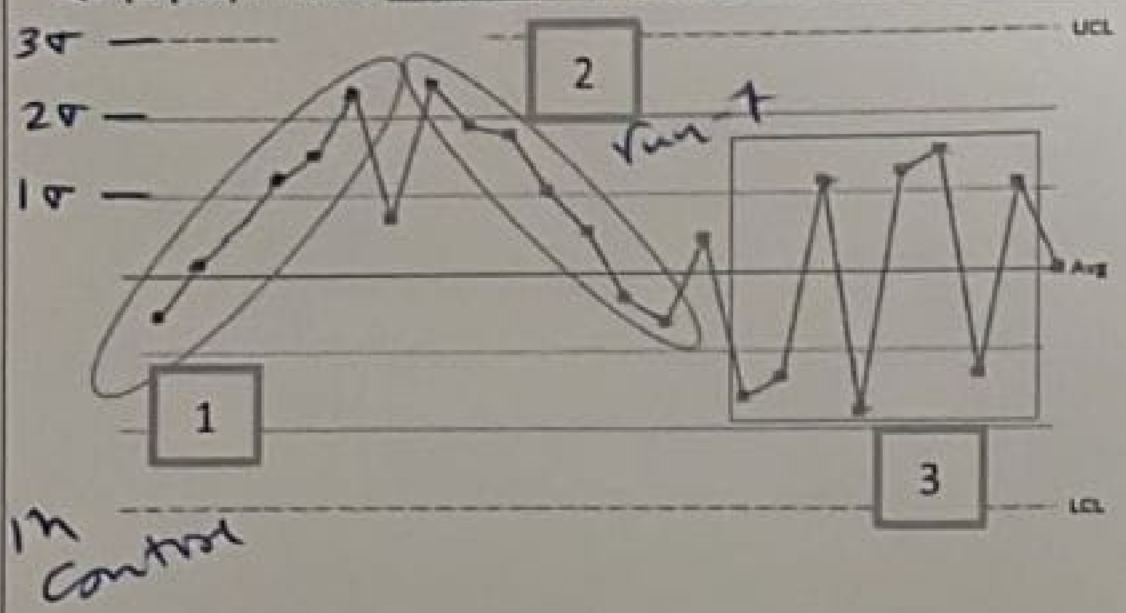
16.5

Q1 (16 pts*) Please state whether each statement is True/False. Please correct the false part.

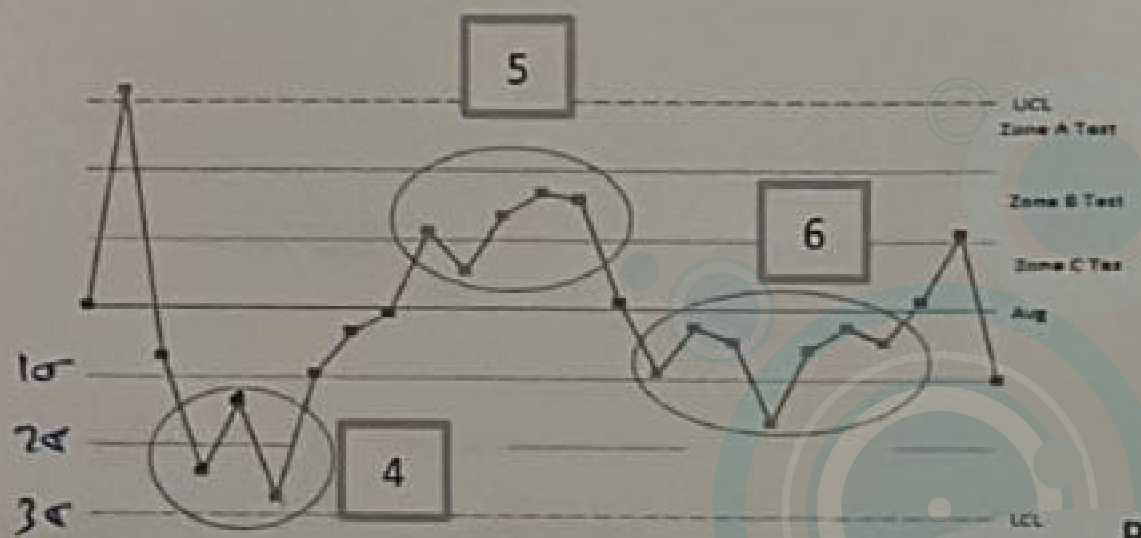
- A check sheet is a simple frequency distribution of attribute data arranged by category. pareto chart (F)
- The control charts used for monitoring discrete quality characteristics are called control charts for variables. (F) attribute control chart
- Supplier's evaluation before purchasing raw material is an example of appraisal costs. (F) prevention
- The control chart only detects nonrandom patterns due to assignable causes. (T)
- The sigma level means the chance of differences between subgroups will be maximized. → rational subgroup, Snap shot (consicutive) (F)
- The value stream mapping is analyzed to determine whether the location of the defects on the unit conveys any useful information about the potential causes of the defects. (F) defect concentration diagram
- The Pareto chart is best suited for large data sets. (F) histogram −2
- The control chart for monitoring a process operating with chance causes displays nonrandom patterns. (F) random pattern
- The 3-sigma control limits are called the warning limits. (F) action limits, control limits
- A defect concentration diagram is a useful plot for identifying a potential relationship between two variables. (F) Scatter Diagram
- The need for process adjustments due to mean shift results in a statistical control condition of the control chart. (F) out-of-statical
- Generally, 6 consecutive points increasing or decreasing indicate a high probability of the existence of random causes. (F) run, out-of-control
- The tie chart involves the flow of material and information in a process. (F) Value stream mapping
- In phase I, it is usually assumed that the process is reasonably stable. (F) intially out of control
- The costs incurred due to customer dissatisfaction are an example of indirect costs. (F) external failure cost
- The consecutive sampling approach is used when the primary purpose of the control chart is detecting mean shifts. (T)
- In rational subgroups, a set of process data is gathered and analyzed all at once in a retrospective analysis, constructing trial control limits. ~~check sheet~~ (F) Phase (I)
- The control chart consists of control limits and a target. (F) Center line and control limits
- The box plot relies on the 50 % percentile only for describing process variation. Stem and leaf (F)
- The costs related to materials used in retesting reworked units are prevention costs. internal failure cost (F)
- The assignable causes are unavoidable and result in nonrandom patterns in the control chart. avoidable (F)
- The processing time of a product = 20 minutes when performed by two operators. The cycle time = 10 (T)
- The check sheet is a formal tool useful in unlayering actual causes. Cause and effect Dia, Potential (F)
- A control chart was constructed to monitor the number of defects on an electronic display. The mean defect rate = 0.001 defect/unit. The UCL of the appropriate control chart = 0.095 (Poisson)

Q3 (2 pts) Please assess the patterns in the control chart based on sensitizing rules. (4 pts)



Pattern 3: rule (8)

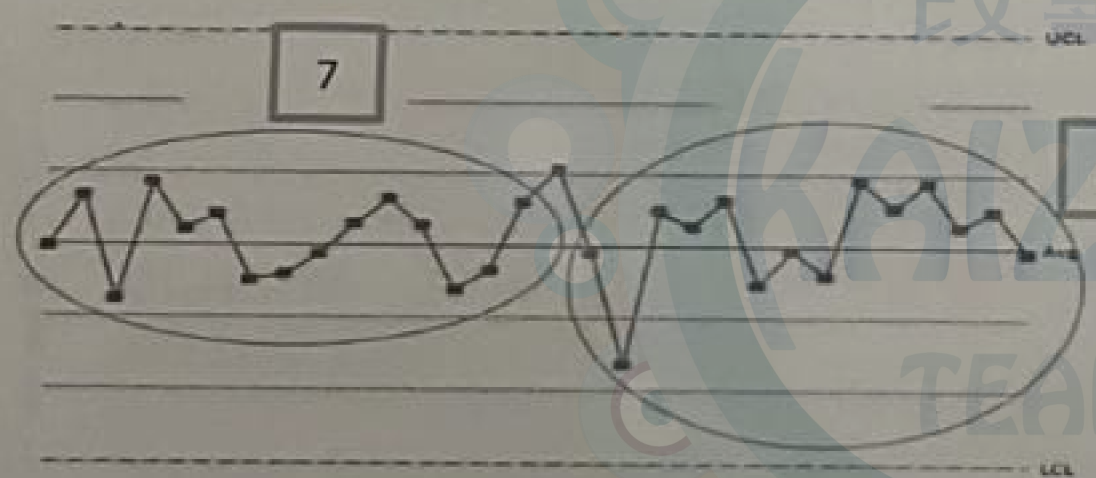
out of control



2

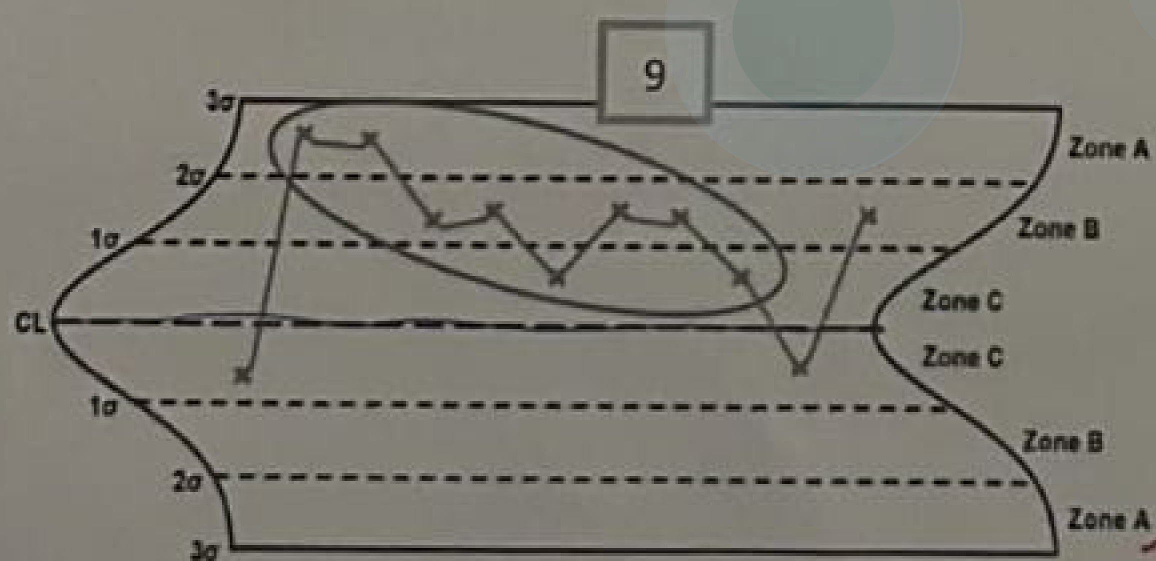
Pattern 4: rule (2)

out of control



Pattern 8: rule (7)

out of control



Pattern 9: rule (4)

out of control

(8) $\frac{1}{40.000}$

(c) The time to failure of a unit is modeled by an exponential distribution with a variance of $40,000^{-1}$ hours. The probability that a product requiring 3 identical and independent units connected in a standby configuration will survive 100 hours = ----------------

$r = 3$

$(40.000^{-1}) = \frac{1}{\lambda^2}$

$\lambda = 200$

$r = 3$

$\lambda = 200$

$a = 100$

$R(100) = e^{-200(100)} \times \sum_{k=0}^{k=2} \frac{(200 \times 100)^k}{k!}$

$= 0$

(d) The time to failure for each unit is modeled by a Weibull distribution with mean and scale parameters of 1000 and 500, respectively. The probability that a unit fails before 400 hours = 0.59

1000 $\theta = 500$

$a = 400$

$F(400) = 1 - e^{-\left(\frac{400}{500}\right)^{1/2}} = 0.59$

$1000 = 500 \, \alpha \left(\frac{1}{\beta}\right)!$

$\left(\frac{1}{\beta}\right)! = 2$

$\frac{1}{\beta} = 2 \rightarrow \boxed{\beta = 1/2}$

(e) If the unit weight is normally distributed with mean and variance of 100 and 9, respectively. The weight specifications are at most 109. The probability of a conforming unit = 0.99865

100 9

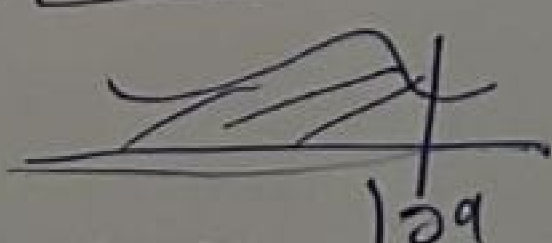
$P(X \leq 109)$

$\sigma = 3$

$\mu = 100$

$P(X \geq 109) = P\left(Z \geq \frac{109 - 100}{3}\right) = P(Z \geq 3)$

$= 0.99865$



(f) The number of defects in each unit is of main interest. Defects occur at a mean rate of 0.01 defects per unit. The probability of finding at most one defect in a unit = 0.99995

$\lambda = 0.01$

Poisson

$P(X \leq 1) = P(X = 0) + P(X = 1)$

$= \frac{e^{-0.01}(0.01)^0}{0!} + \frac{e^{-0.01} \times (0.01)}{1!} = 0.99995$