

2002 S7PM STATISTICAL QUALITY CONTROL - I TEST

Time: 60min

Maximum Marks: 20

Answer any 10 questions

1. Explain David Garvin's eight dimensions of quality.
2. Describe the core concepts of Total Quality Management and the role of SQC in it.
3. How can designed experiments assist in quality improvement?
4. Construct a stem and leaf plot for the data of a life test: 127, 124, 121, 118, 125, 123, 136, 131, 131, 120, 140, 125, 124, 119, 137, 133, 129, 128, 125, 141, 121, 133, 124, 125, 142, 137, 128, 140, 151, 124, 129, 132, 160, 142, 130, 129, 125, 123, 122, 126. Also determine the upper and lower quartiles.
5. A textbook has 500 pages on which typographical errors could occur. Suppose that there are exactly 10 such errors randomly located on those pages. Find the probability that a random selection of 60 such pages will contain at least 2 errors.
6. Define the exponential distribution. What is its mean and variance?
7. The life of a battery used in a cardiac pacemaker is assumed to be normally distributed. A random sample of 10 batteries is subjected to an accelerated life test by running them continuously at an elevated temperature until failure, and the following lives are obtained: 25.5, 26.8, 24.2, 25.0, 27.3, 26.1, 23.2, 28.4, 27.8, 25.7hrs. Construct a 95% lower confidence interval on mean battery life.
8. Two different hardening processes are used on a metal alloy. Saltwater quenching resulted in a mean hardness of 147.6 and sample variance of 24.71 while oil quenching resulted in a mean of 149.4 and variance of 29.82, both over 10 samples. Test the hypothesis that the variances of specimen hardness from the two quenching solutions are equal. Use $\alpha=0.05$.
9. In Q8, is there reason to conclude that the mean hardness resulting from oil quenching exceeds the mean hardness resulting from saltwater quenching? Use $\alpha=0.05$ and assume equal variances.
10. An automatic machine produces resistors. The process is found to have a mean of 1.5 ohms with a standard deviation of 0.1 ohms. Average and range control charts based on 2 sigma limits and a sample size of 5 are used. Determine the Average Run Length on the average chart if the process shifts by 0.15 ohms.
11. What is meant by the statement that a process is in a state of statistical control? If a process is in a state of statistical control, does it necessarily follow that all or nearly all of the units of product produced will be within the specification limits. Discuss.
12. A manufacturing process produces 500 parts per hour. A sample part is selected about every half-hour, and after five parts are obtained, the average of these five measurements is plotted on an \bar{x} control chart. Is this an appropriate sampling scheme if the assignable cause results in an instantaneous upward shift in the mean that is of very short duration? If not, explain why and propose an alternative procedure.