1. Service calls come to a maintenance center according to a Poisson process and on the average 2.7 calls come per minute. Find the probability that:

(a) no more than 4 calls come in any minute.
(b) fewer than 2 calls come in any minute.
(c) more than 10 calls come in any 5-minute period.

2. Surface-finish defects in a small electric appliance occur at random with a mean rate of 0.1 defects per unit. Find the probability that a randomly selected unit will contain at least one surface-finish defect.

3. An inspector is looking for nonconforming welds in a pipeline. The probability that any particular weld will be defective is 0.01. The inspector is determined to keep working until finding three defective welds. If the welds are located 100 ft apart, what is the probability the inspector has to walk 5000 ft? What is the probability the inspector has to walk more than 5000 ft?

4. The life of an automotive battery is normally distributed with mean 900 days and standard deviation 35 days. What fraction of these batteries would be expected to survive beyond 1000 days?

5. A light bulb has a normally distributed light output with mean 5000 end foot-candles and standard deviation of 50 end foot-candles. Find a lower specification limit such that only 0.5% of the bulbs will not exceed this limit.

6. A quality characteristic of a product is normally distributed with mean \( \mu \) and standard deviation one. Specifications on the characteristic are \( 6 \leq x \leq 8 \). A unit that falls within specifications on this quality characteristic results in a profit of \( C_0 \). However if \( x < 6 \), the profit is \(-C_1\), while if \( x > 8 \), the profit is \(-C_2\). Find the value of \( \mu \) that maximizes the expected profit.

7. The life in years of a certain type of electrical switch has an exponential distribution with an average life of 2. If 100 of these switches are installed in different systems, what is the probability that at most 30 fail during the first year?
8. A production process operates in two states; the in-control state in which most of the units produced conform to specifications, and an out-of-control state in which most of the units produced are defective. The process will shift from the in-control to the out-of-control state at random. Every hour, a technician checks the process, and if it is in the out-of-control state, the technician detects this with a probability $p$. Assume that when the process shifts out of control it does so immediately following a check by the inspector, and once a shift has occurred, the process cannot automatically correct itself. If $t$ denotes the number of periods the process remains out of control following a shift before detection, find the probability distribution of $t$. Find the mean number of periods the process will remain in the out-of-control state.