

Home Works for Chapter 6

Q1. A transistor has an time to failure following an exponential distribution with mean time to failure of $\beta = 20,000$ hours.

- (a) What is the probability that the transistor **fails** in 30,000 hours of use?
- (b) The transistor has already lasted 20, 000 hours in a particular application. What is the probability that it **fails** in 30, 000 hours of use?
- (c) Comment on the probability in (a) if $\beta = 10000;30000;40000;50000;60000$

Q2. The lifetime X (in hours) of the central processing unit of a certain type of microcomputer is an exponential random variable with parameter 0.001. What is the probability that the unit will work **at least** 1,500 hours?

Q3. The lifetime (in hours) of the central processing unit of a certain type of microcomputer is an exponential random variable with mean $\beta = 1000$.

- (a) What is the probability that a central processing unit will have a lifetime of **at least** 2000 hours?
- (b) What is the probability that a central processing unit will have a lifetime of **at most** 2000 hours?

Q4. Let X denote the number of flaws along a 100-m reel of magnetic tape. Suppose X has approximately a normal distribution with $\mu = 5$ and $\sigma = 5$. Calculate the probability that the number of flaws is

- (a) Between 20 and 30.
- (b) At most 30.
- (c) Less than 30.
- (d) Not more than 25.
- (e) At most 10

Q5. A machining operation produces steel shafts having diameters that are normally distributed with a mean of 1.005 inches and a standard deviation of 0.01 inch. Specifications call for diameters to fall within the interval 1.00 ± 0.02 inches.

- (a) What percentage of the output of this operation will fail to meet specifications?
- (b) Comment on the percentage in (a) if σ increases to 0.015 inch.

Q6. The weekly amount spent for maintenance and repairs in a certain company approximately follows a normal distribution with a mean of \$400 and a standard deviation of \$20.

- (a) If \$450 is budgeted to cover repairs for next week, what is the probability that the actual costs will exceed the budgeted amount?
- (b) Comment on the probability in part (a) if μ changes, keeping σ fixed.
- (c) Comment on the probability in part (a) if σ changes, keeping μ fixed.

Q7. Consider a binomial random variable with 20 trials and success probability 0.45. Using the normal approximation

- (a) Compute the probability of finding **at least** 3 successes.
- (b) Compute the probability of observing **at most** 16 successes.
- (c) Compute the probability that the number of successes **is equal** to 3.
- (d) Compute the probability that the number of successes **is equal** to 12.