Chapter 1

1.1 Assume that there are two algorithms *A* and *B* for a given problem P. The time complexity functions of algorithms *A* and *B* are 5n and $\log_2 n$ respectively. Which algorithm should be selected assuming that all other conditions remain the same for both the algorithms?

Solution:

⇒ For all values of '*n*', $\log_2 n$ is smaller than 5*n*.

For example, for n=1024, $\log_2 1024 = 10$ but $5n = 5(1024) = 5120$ operations.

Therefore, Algorithm B having complexity $\log_2 n$ is preferred.

1.2 Let us assume that for a telephone directory problem P, three algorithms exist, A, B and C. Time complexities of A, B and C are 3n, 5n and log *n* respectively. Assume that the input instance *n* is 10^5 10^3. Assume that the machine executes 10^9 instructions per second. How much time will algorithms *A*, *B* and *C* take? Which algorithm will be the best?

*Solution***:**

⇒ Here n $= 10^5$. At computer executes 10^9 instruction / sec.

$$\therefore \ Time_A = \frac{3(10^3)}{10^9} = \frac{3}{10^6} = 0.000003 \ Sec$$

$$Time_B = \frac{5(10^3)}{10^9} = \frac{5}{10^6} = 0.000005 \ Sec$$

$$Time_C = \frac{\log(10^3)}{10^9}$$

Assuming base 10, $\quad \dfrac{\log_{10} 10^3}{10^9} = \dfrac{3}{10^9} = 0.000000003 \ Sec$

∴ Third algorithm is best one.