By Pumping Lemma, Language $L = \{0^k 1^k : k \geq 0\}$ is not Regular (9)

Pf. If possible let $L = \{0^k 1^k ; k \geq 0\}$ be regular & x be any string with $|x| \geq n$. Reasonably we choose $x = 0^n 1^n$. Then from pumping lemma, $x = uvw$ for some u, v, w satisfying $|uv| \leq n$, $|v| > 0$, for $m \geq 0$ we have $x_m = uv^m w \in L$

Now v can be in foll. 3 forms

(1) $v = 0^j$, $j \geq 1$ (2) $v = 1^{j'}$, $j' \geq 1$

(3) $v = 0^q 1^r$, $q, r \geq 1$

In 1st case if we take $m = 2$, then

$$x_2 = uv^2 w = 0^{n-j} (0^j)^2 1^n$$
$$= 0^{n+j} 1^n$$

Since $n + j \neq n$ $(j \geq 1)$ $\therefore x_2 \notin L$

In 2nd case, when $m = 2$ then

$$x_2 = uv^2 w = 0^n (1^j)^2 1^{n-j}$$
$$= 0^n 1^{n+j}$$

Again as $n + j \neq n$ $(j \geq 1)$ $\therefore x_2 \notin L$

When $v = 0^q 1^r$ then taking $m = 2$

$x_2 = 0^{n-q} (0^q 1^r)^2 1^{n-r} = 0^{n+q} 1^{n+r} \notin L$

- Contradiction $\Rightarrow L$ is not Regular

Schaum P64

Algorithm – Sequence of steps to solve a problem in English like language.

Complexity of Algorithms –

In order to compare algorithms, we must have some criteria to measure efficiency of the algorithms.

Suppose M is an algorithm & suppose n is the size of input data. The time & space used by the algorithm are the 2 main measures of efficiency of M.

Time is measured by counting the no. of "key operations".

ex. (1) In sorting & searching, one counts the no. of comparisons. ex. bin Tree sorting.

(2) In arithmetic, one counts multiplications & neglects additions.

Key operations are so defined when the time for other operations is much less than or at most proportional to the time for key operations.

Space is measured by counting the maximum of memory needed by the algorithm.

The Complexity of an algorithm M is the function $f(n)$ which gives the running time and/or storage space requirement of the algorithm in terms of the size n of the input data. Frequently, the storage space required by an algorithm is simply a multiple of the data size. The term "Complexity" generally refers to the running time of the algorithm