

DEFINITION 8.1 - RELATIVE TURING COMPUTABILITY (TURING, 1939):

1) An *oracle Turing machine* T is a Turing machine with an *oracle Turing program* \widehat{P}_e consisting of the usual kinds of quadruple, together with quadruples of the kind

$$q_i S_k q_j q_l \quad (S_k \text{ a tape symbol}).$$

\widehat{P}_e computes in the usual way from input x , except that when it applies $q_i S_k q_j q_l$ it counts up the number of 1's on the tape (say n), asks the *oracle* (A say) "Is $n \in A$?", and if the answer is "yes" T goes into state q_j , and if "no" T goes into q_l .

2) ψ is *A-Turing computable* iff ψ is computable by an oracle Turing machine with oracle A .

3) Then A is said to be *B-Turing computable* (written $A \leq_T B$), or *Turing reducible to B*, iff C_A is *B-Turing computable*.