N & Evens, Q, Z, N2, Nk, TMs N & Reals (R), (O,1), IBS Goal: E, 7 ALL 1 is an equivalence 18 2 AZA XCY Hen YCX N + REAS XZY and YZZ Hen XZZ E, IN? & A E E, iff 3 METM, L(m) = A 5 × LN Goal: ALL 2 RQ 2 IBS Whatis ALL? A EALL if A is a set of strings of Ex ALL = 180 ( 5\* ) ALL-P(E") = Ø {E} £03 £13 ... £0,13., £0,0003... elements of ALL (P(E\*)) are sets of strings La member ship function member: Elem > Y/N E\* Oor 1 ( \lambda n, n % Z == 0) = Evens elements of ALL are IBSes IBS = 1n.0 = 0

Reducibility

A is reducible to B (A & B) if If E computable for

f: B => E =" (Turing diadputs answer

Sit. We Have a "B" machine and an "f" machine, Hen you

can make an "A" machine

 $A \leq_m B$  and  $B \in \leq_0 \implies A \in \leq_0$  $A \leq_m B$  and  $A \notin \leq_0 \implies B \& \leq_0$ 

ETM = E < M > | METM and L(m) = Ø3 & Zo

ATM  $\leq_m$  ETM VIA a way to turn ATM problems into ETM problems  $f(\langle M, w \rangle) \in E_{TM}$  if  $f(\langle M, w \rangle) \in A_{TM}$   $L(f(\langle M, w \rangle)) = \emptyset$   $f(\langle M, w \rangle) = \emptyset$   $f(\langle M, w \rangle) = \emptyset$ 

LEAM L(M') ES iff WEL(M)

M' = 'On input x, simulate Mon w if accepts, reject o.w., accept "

FLLTM & Ed

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REGIM = ECM7 | METM and L(M) EREG3 £ 20 f: (mins => (m') ATM Em REGTM f(cm, w) + REGIM off <M, w> EATM L(M') EREGE ;ft = weL(m) m' = "On input x, simulate M on w if accepts, Hen accept O.W. check if x is 0"1" " CFLTM & Eo by picking on 1 non Ricers Theorem proces all "non-bring" P are undecideble EGTM = ECMIN> 1L(M)=L(N)3 ETM EM EGTM t((W)) = (W) 0>

26-4/ Variant of TM called LBA Linear Bounded Automata LBAL= (Q, E, MB, S: QXM > QXMXEL, RB, ga, gr) we L(l) iff w[80] ww => " u[80] v but there is no whe for adding blanks TUBA = TM w/ a finite tape (input + 2 blanks) Suggest . TM: u[q:]v=> uu[q:]vu LBA:  $S(q;, \alpha) = (q;, b, R)$   $S(q;, \alpha) = (q;, b, L)$ ⊔ u[q;] av => ∪ u b(y) u c[q;] av => u[q;] cbv ALL examples of Eo were really LBAs M= Eu Eu3 u useful M= TxZ 12 = 2 0 8m3 0 (12 x 12) ALBA & Eo LBAs - accept reject loop diverge < spin Config = U[q:]V = Q x N x Px x Tx ELBA

ELBA Make an LBA to check if an

M non accepts w

if no valid nous exist, Hen was L(m)

