Chapter 1: Regular Languages -3 (Section 1.1 Finite automata (DFA's) Section 1.2 Non-deterministic finite automata (NFA's) - elgurithms Section 1.3 Regular Expressions ( Injunges Section 1.4 Proving certain languages are not regular -Real stary 1. OFA's & NFA's are very simple algorithms - Keal story 2: grep, egrep (extended grep), looking in many long text files, searching for the occurrence of certain substrings, Unix/Linux builds NEA or DEA Finite autometa ; Consider some simple languages, e.g.  $DIV_BY_2 = \left\{ s \in \{c_{j,1}, \dots, q\}^{*} \right\}$ 5 represents an integer dvisible by 2 leading O's not OK empty string, E, not OK 0, 2, 4, 117396, 12 E DIV\_BY\_2 & DIV\_BI-Z 13, 121, 012,2 1234567809312 in DIV\_Bi-2 Algeriahn: Is

Intuitively ! build a simple, left - to-right scan of 1234567809312 start finite set of states, Q, Finite automation has: involves finite alphabet, 5, 0,1,3 come state any state Example : , - reject E DIV-BY-Z - reject Bother shelf - accept  $\bigcirc$ accept if 5k= 0, 2, 4, 58 S. - ~ - 5k - otherwise indicator initial state reject if 5k=1,3,5,7,9 -storys and have ever 1,3,5,7,9 Qo = Mitial State 1,3,5,7,9 not I've just sten an ood DIV\_BY\_Z 2,4,6,8 0,2,4,58 0 1,3,5,7,9 I've bot seen Special. CLSC an even stres ending 0,2,4,58 digit this state are 0,1,-..,9 haver 1- DIV\_BY\_2 accept 234567809312md 0,1,.~,9 start Speciel cases: E es reject 0 es accept OS.-SI carejest

1,3,5,7,9 1,3,5,7,9 Qo 9 odd 2,4,6,8 1.3,5,7,7 0,2,4,68  $\mathcal{O}$ geven 9 specia 10, -, 9 0,2,4,6,8 Gleading O 00,1,--,9 Formally ! states Q, Z= alphabet, S: Q×Z->Q E(q, T) = the state that you more to 90 = mitic state from g seeing "accepting state" " final states" F the symbol o Formelly : a deterministic finite autometer is a 5-type (Q, S, d, qo, F) Sit. - - [legel document] DIV\_BY\_3 = { J < { G, 1, ..., q} } J represents an integer dividele by 3 PRIMES 5 represents a prime 15 number We say that a language is regular if there is a DEA recognizes the languages To show regular, E.g. DIV\_BY\_2, DIV\_BY\_3, are regular need to Sources, PRIMES, is not regular } have to show build a DEA that recognises

see if what we have so DEA: ider : DW\_B?\_3: (1)<sup>13</sup> dwissble by 3 for iz جر لارا something there (2) mod 3 īs l (3) mod 3 is 2 mad 3,0 9. 3 15 0 mod C, 3, 6, 9 6,4,7 0 2,5,8 1,4,7 hod 2 71 2,5,7 71. 2,5,8 anything mod 3 15 0,3,69 9 mod 3 0,3,6,9 any thing E 9 mad 3,7 mod 3,0 95 where we 90 6 finish a E