

Programming with relations

Spreadsheets Excel, Pandas, CSV	SQL relational algebra	Graph databases Neo4j Cypher	Recursive query languages Prolog / <u>Datalog</u>
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Q1: When is a spreadsheet well-formed?

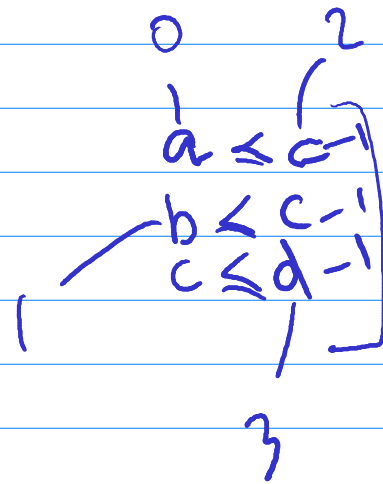
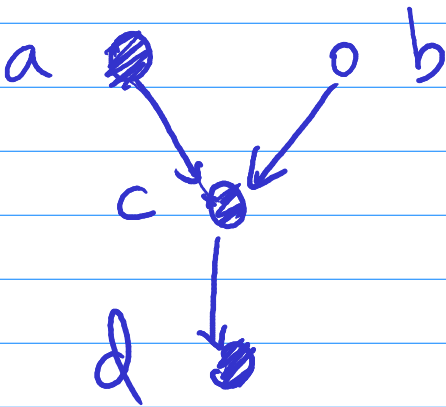
Each cell is syntactically well-formed →
Graph of refs must form a DAG.

Q2: What is the counterpart of pointers?

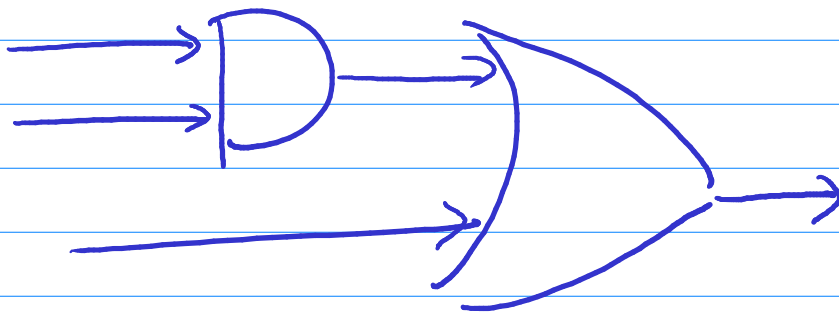
Q3: What is the counterpart of dictionaries?

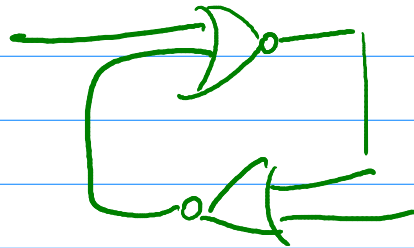
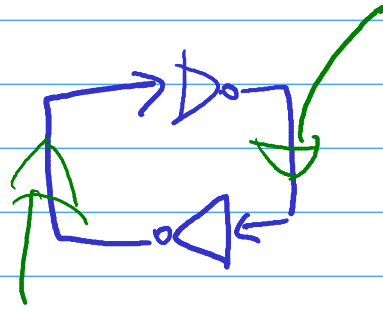
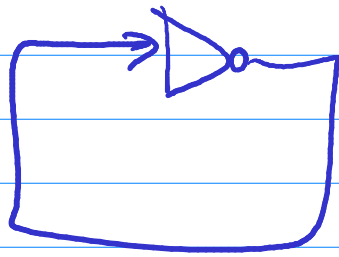
Q4:

Graph of references must form a DAG



Simplex
Linear programming





Q2 : Excel's pointers!

* X
pointer derefs

INDIRECT

& X

ADDRESS

(X+3)
pointer
arithmetic

(deterministic)
Simulating an automaton in Excel

