18-847 Lab Assignment 4

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Question 3

Similarity search is a critical primitive for a wide variety of applications including natural language processing, content-based search, machine learning, computer vision, databases, robotics, and recommendation systems. Similarity search is implemented using the k-nearest neighbours (kNN) algorithm, where computation consists of highly parallel distance calculations and a global top-k sort. In contemporary von-Neumann architectures, kNN is bottlenecked by data movement which limits throughput and latency. Generalized race logic might help minimize data movement bottleneck and might be able to achieve better performance.

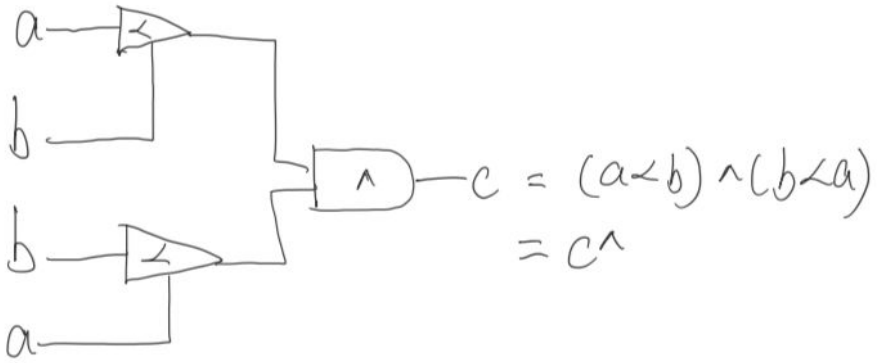
In the below paper, an automata-based algorithm for kNN on the Micron Automata Processor (AP) is presented, which is a non-von Neumann near-data processing architecture. It combines temporal encodings with automata design to augment the space of applications for the AP.

Similarity Search on Automata Processors

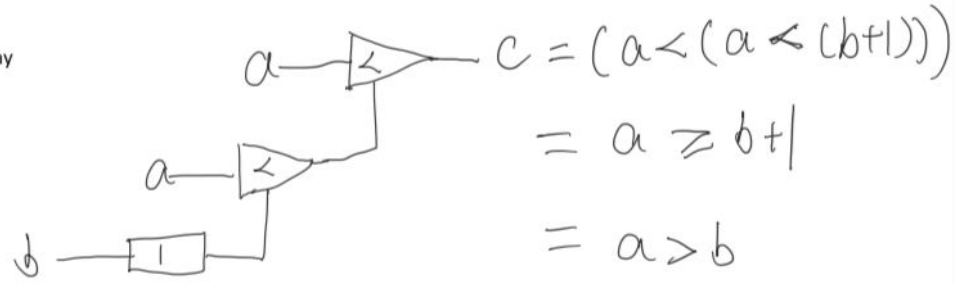
Vincent T. Lee ; Justin Kotalik ; Carlo C. del Mundo ; Armin Alaghi ; Luis Ceze ; Mark Oskin , 2017

Question 4

Exlusive min using min and lt



Greater than using min and delay

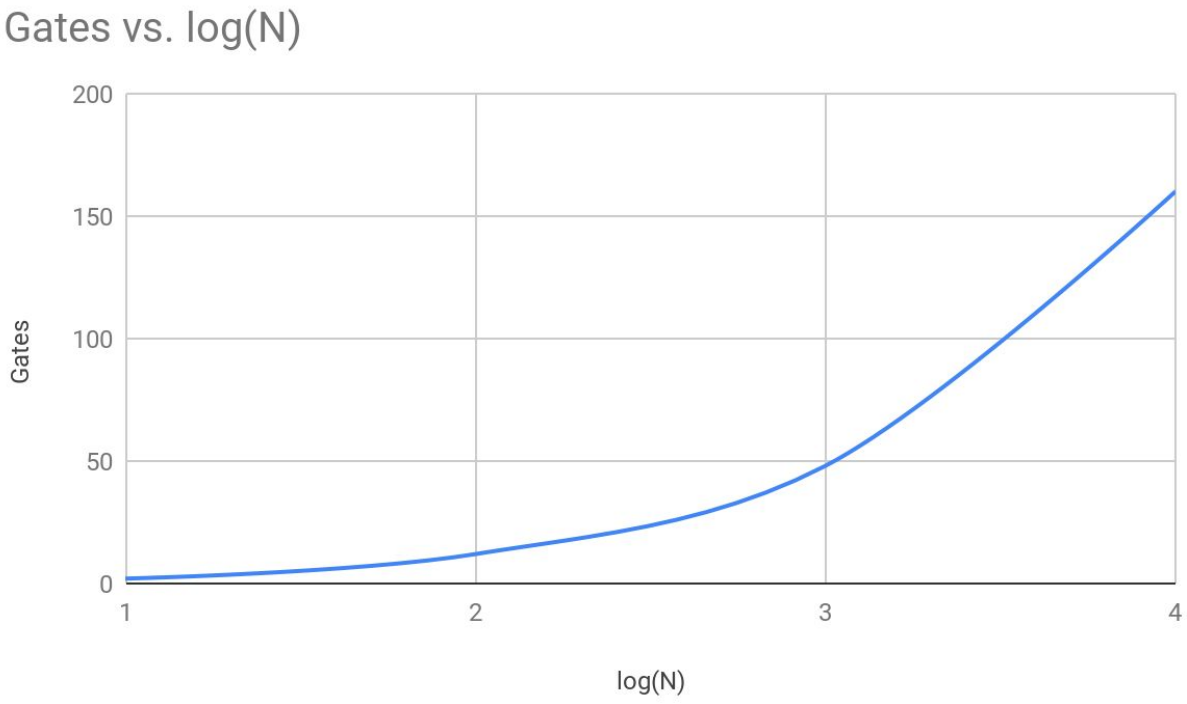


6.1

How many gates are present in a bitonic sorter with N inputs?

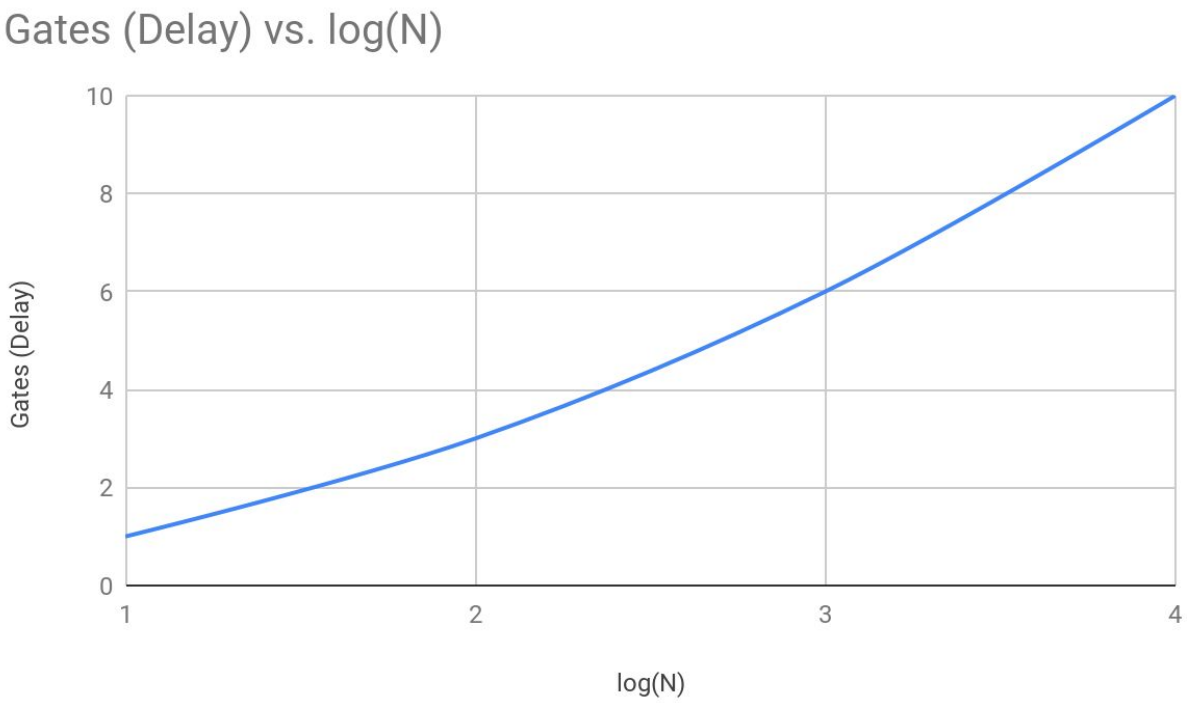
F(N) = N*(logN+1)logN (log is based with 2)

N	2	4	8	16
Gates	2	12	48	160



How many gates are present between an input line and its corresponding output line for an N-input sorter?
F(N) = Number of gates present between an input line and its corresponding output line for an N-input sorter
F(N) = 0.5*(logN+1)logN

log(N)	1	2	3	4
Gates (Delay)	1	3	6	10



Question 7

Metrics	Qualitative Values	Simulation Values
Area	160	212.799997 um^2
Latency	10	0.66 ns
Power	160	5.4933 uW