

Modern Societal Needs: Information, Algorithmic, and Computational Thinking and Training, in Large Numbers

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Society changes, Schools must follow – or rather *lead*!

- Technology advances, affecting society
 - make tasks easier, increase productivity
 - shift to intellectual, *creative* professions
 - away from manual or *repetitive* tasks
- Schools must adapt to societal changes...
- or rather: *Schools must lead societal changes!*
 - schools educate the next generation – our future
 - our future depends on those who create it – on current students

Information & Communication Technologies (ICT)

- ICT drives the modern technology & society revolution
 - knowledge is power
 - speed and ease of information access and processing provides countless new, previously unknown opportunities
 - ICT is still in its *infancy*!
 - self-driving cars? drones? drug design? next google/fb/AirBNB?
 - system reliability, security, privacy, performance, ease of use?
 - parallelism, artificial intelligence: still in their infancy
 - huge complexity to build these – “*labor*” (*intellect*) *intensive*!
- ⇒ Need many-many more ICT professionals!

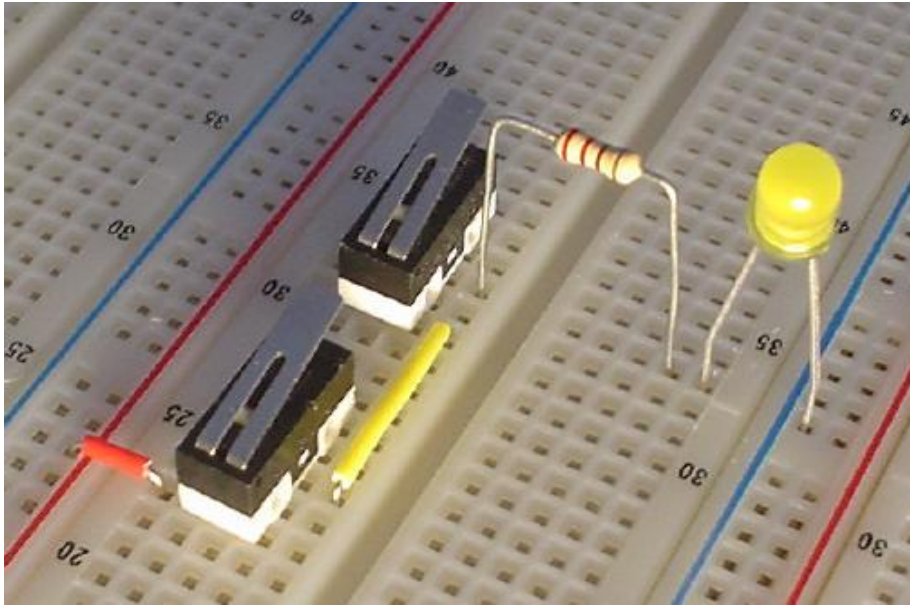
Reorient Education towards the Professions needed

- Need more intellectual, creative professionals, and less people in manual or repetitive tasks
 - Need many more ICT professionals, world-wide
 - Would more ICT graduations lead to unemployment?
 - definitely *not* – example 1: Israel in the 90's
 - definitely *not* – example 2: AMCC-Greece (missed), 1998
 - On the contrary, availability of *high-quality* ICT professionals is a pre-requisite for economic growth
- ⇒ Attract youngs (male *and* female) towards STEM and ICT!

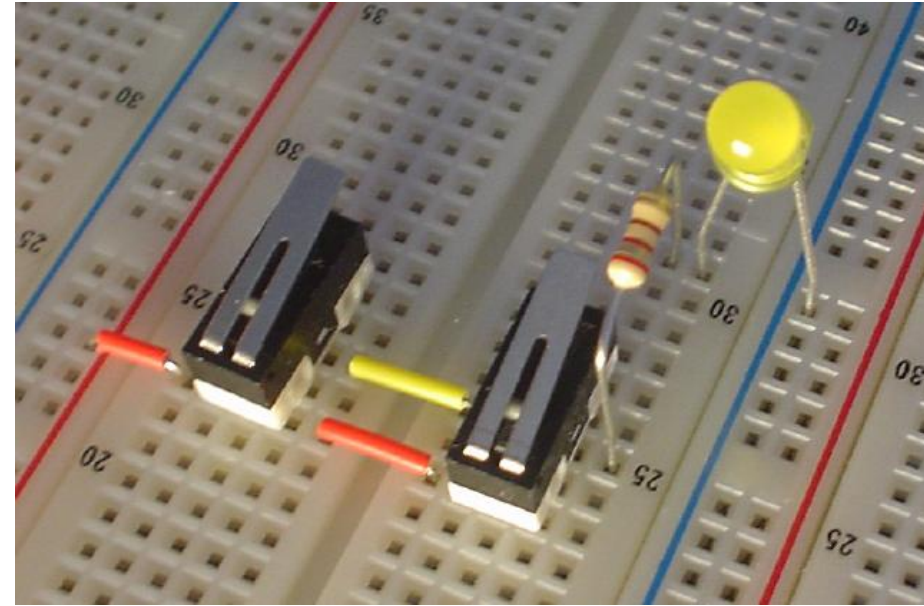
We need to *both use and understand* ICT better

- ICT is a new Tool for almost everything in life
 - need training in using ICT in the other professions and activities
 - digital competences must be acquired in the classroom
- Information and Algorithms, as a (new) Way of Thinking, must also be cultivated into the next generations
 - What is Information, how is it represented, processed, derived
 - Algorithmic thinking: related to mathematics (rigorous, correct) and engineering (how to achieve a goal), yet separate from both
 - Understanding computers and computations
- True Engineering in school: design & build (\neq just solve)

Examples from Univ. of Crete: can we move these to School?

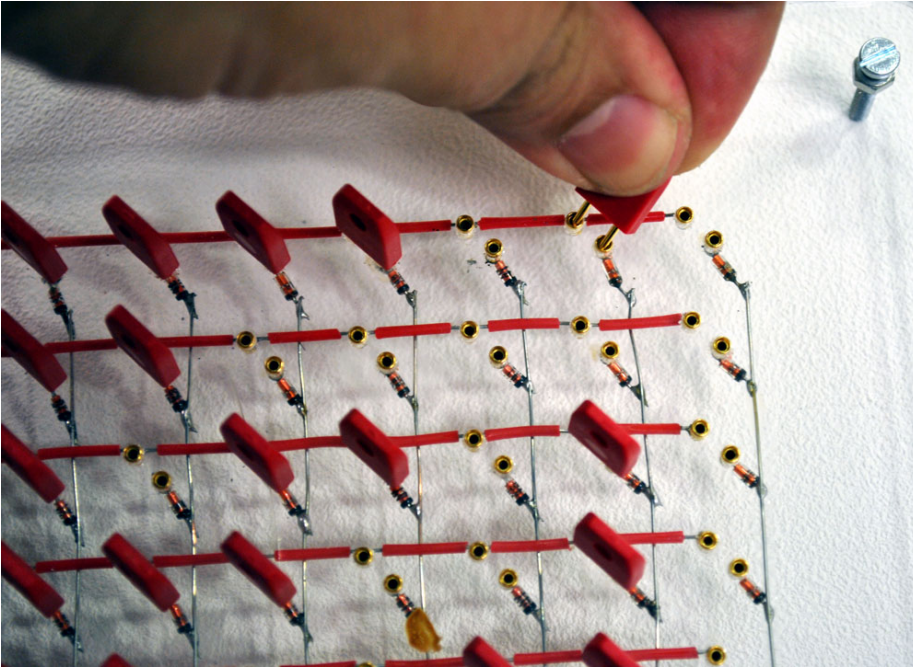


Switches in Series:
Logical AND



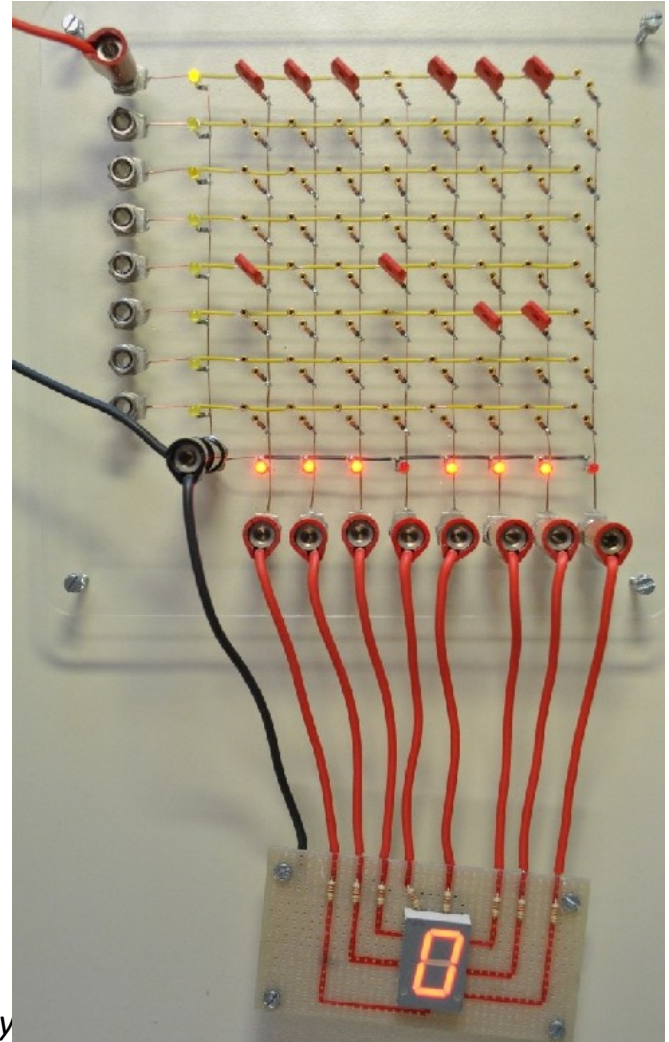
Switches in Parallel:
Logical OR

Examples from Univ. of Crete: can we move these to School?



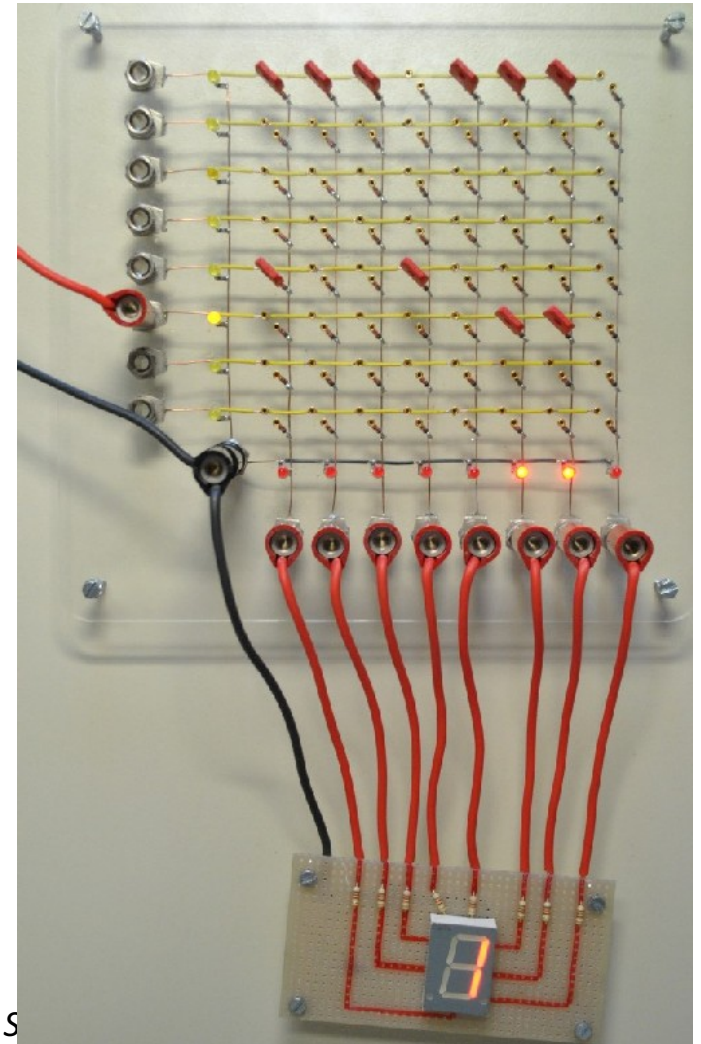
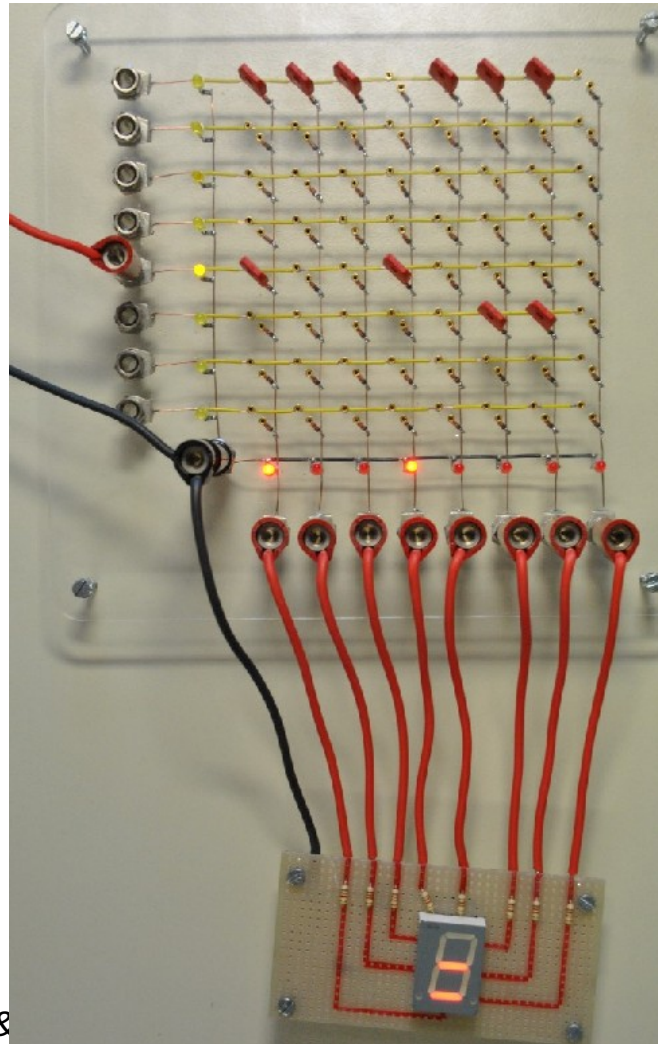
Each red shunt “joins” a row to a column

A Memory (8 words \times 8 bits per word)

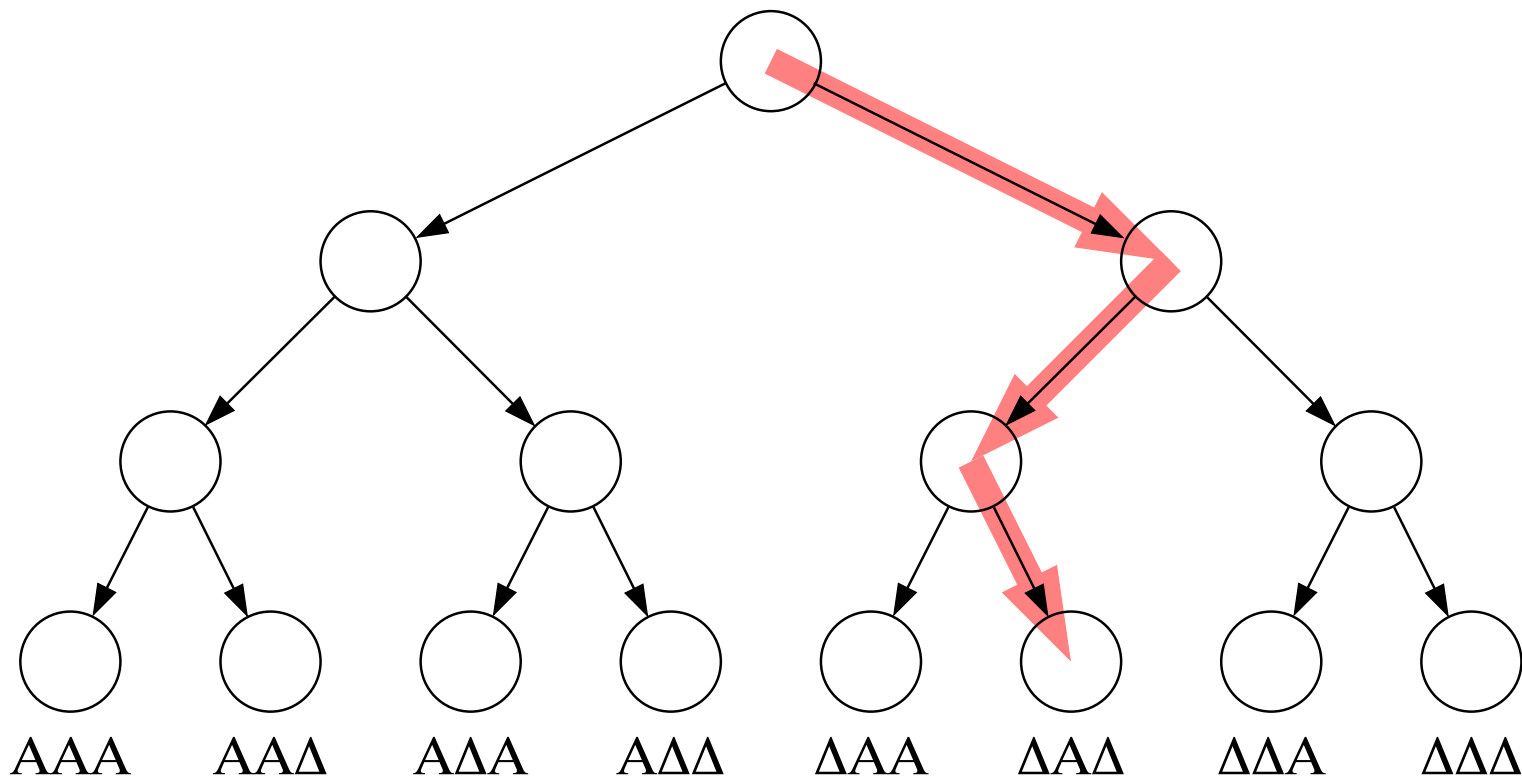


Examples from Univ. of Crete: can we move these to School?

reading two
other words
out of this
memory

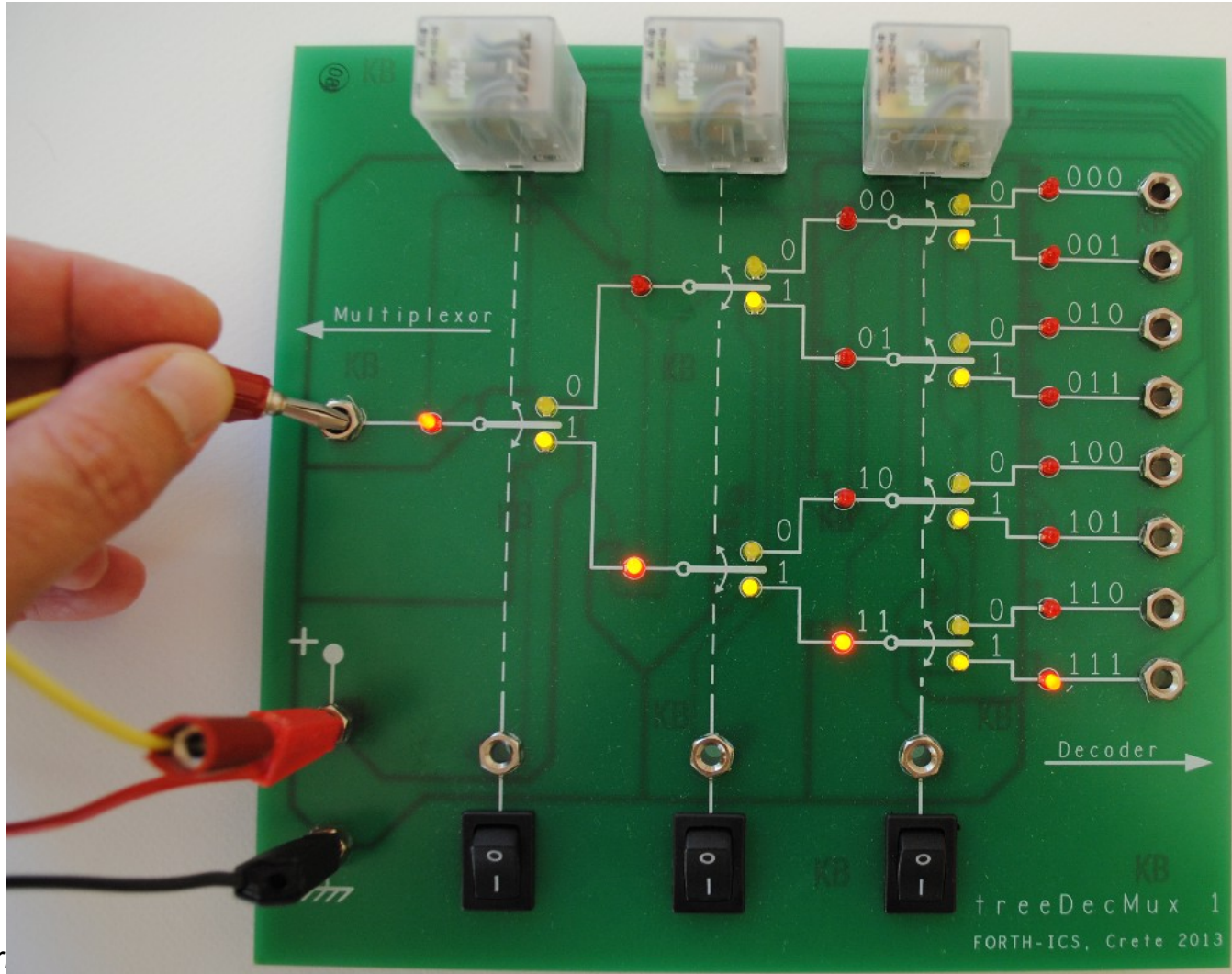


Examples from Univ. of Crete: can we move these to Schools?



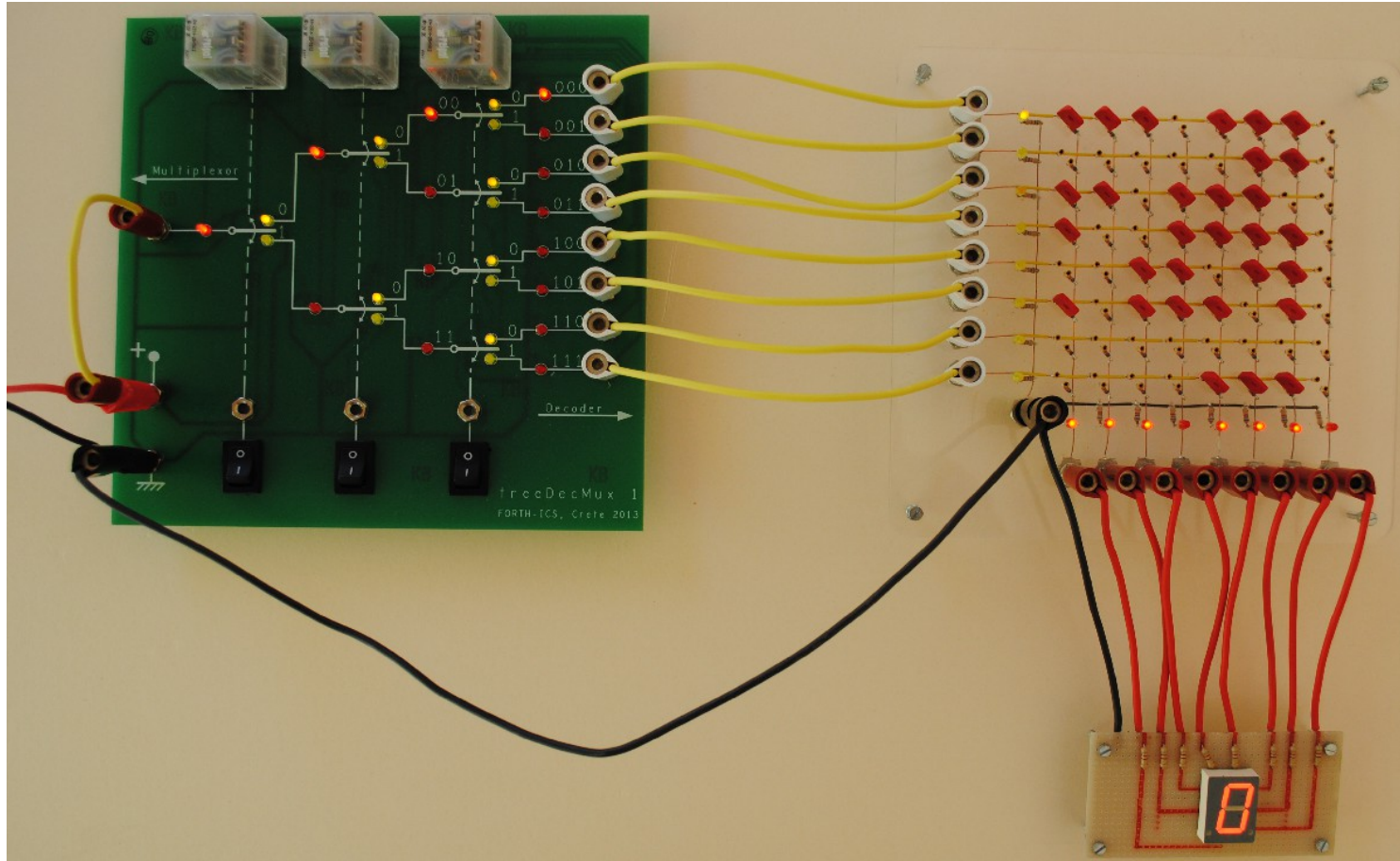
A Decision Tree

Examples from Univ. of Crete: can we move these to Schools?



Address
Decoder
built out
of a
Decision
Tree

Examples from Univ. of Crete: can we move these to Schools?



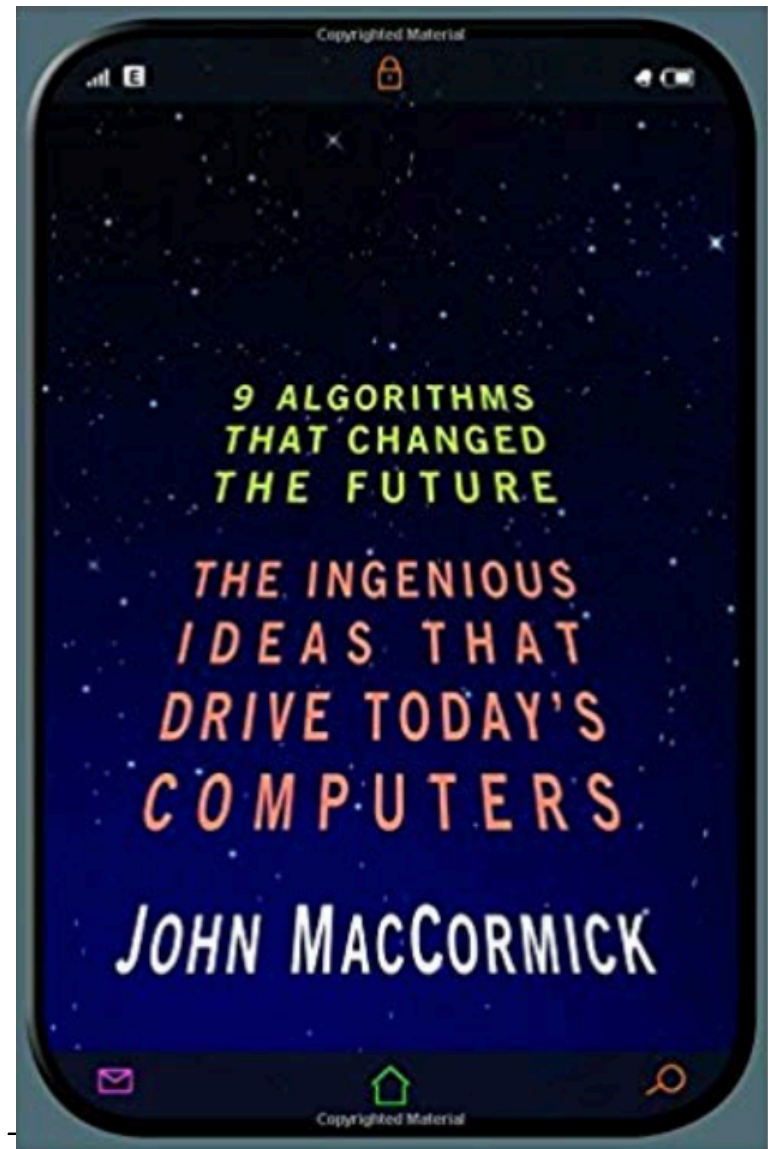
Address Decoder connected to the Memory

Other Example: a Book for High School?

Ideas only, no prerequisites

- Google search/rank algorithm
- Public-key Cryptography
- Error correction codes
- Pattern recognition, machine learning
- Data compression, Data Bases
- Digital signatures
- Computability

Greek translation by Crete Univ. Press



Conclusions

- Reorient education *and* profession topics
 - more intellectual, creative professionals – *not* for repetitive tasks
 - many more ICT professionals needed, of high quality
 - vocational guidance
- Everybody to become a better *user* of ICT
- Everybody to better *understand* ICT
 - Information, Algorithmic, Computational Thinking
- Attract youngs (male *and* female) towards STEM and ICT