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Transdichitomous RAM [Fredman & Willard]

(covered in L2)

- RAM with words of $\geq \lg u$ bits each.
  (need enough address space to index items!)
- Bridges problem size (n & u) and machine model.
- Manipulating $O(1)$ words takes $O(1)$ time.
  $-, +,$ AND, OR, XOR, SHIFT-by-k, ...

Finding 1 bits

Problem: given word, find index of least significant 1-bit.

- On all-powerful RAMs can do this in $O(1)$ time by defining it as an instruction
- It's an instruction on many real chips too
  Cray, Pentium+ (these days as fast as int. +)
  (Linux kernel)
- can be done with $O(1)$ arithmetic & Boolean ops. [Brodnik 1993]
- easy solution using lookup table:
  - can store all solutions for w-bit strings using $O(2^w \cdot \lg w \cdot \lg u)$ bits of storage (and about that time)
    $T: 2^w \to \lg u$.

$\Rightarrow \lg u/2$-bit strings using $O(\sqrt{u} \lg u)$ space.

- Split $\lg u$-bit string into 2 halves, search in lower half, then higher half
  $O(1)$ time
  $O(\sqrt{u} \lg u)$ extra space