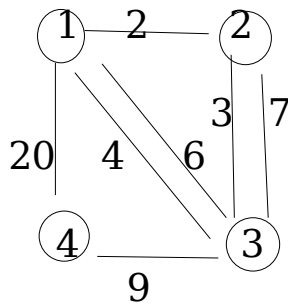


# Research Topics in Algorithm Engineering Group

**Shortest paths**, researcher Tian Lin, Masters



$n = 4$ , number of vertices  
 $m = 6$  number of edges

Single source best result in general  $O(m + n \log n)$   
 size of largest sc-components  $k$ ,  $O(m + n \log k)$ , Takaoka 1995  
 number of trigger vertices  $r$ ,  $O(m + r \log r)$ , Shane 2004

All pairs, researcher Tad

0	2	5	14
7	0	3	12
4	6	0	9
-	-	-	0

$O(n^3 \log \log n / \log n)$ , Takaoka 2005

**Combinatorial generation.** To generate combinatorial objects in  $O(1)$  time per object Example of parenthesis strings

- (( ( ( ( ) ) ) ) )
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Topics parenthesis strings  
 multiset permutations  
 multiset combinations

D. E. Knuth Volume 4

Ivory tower research

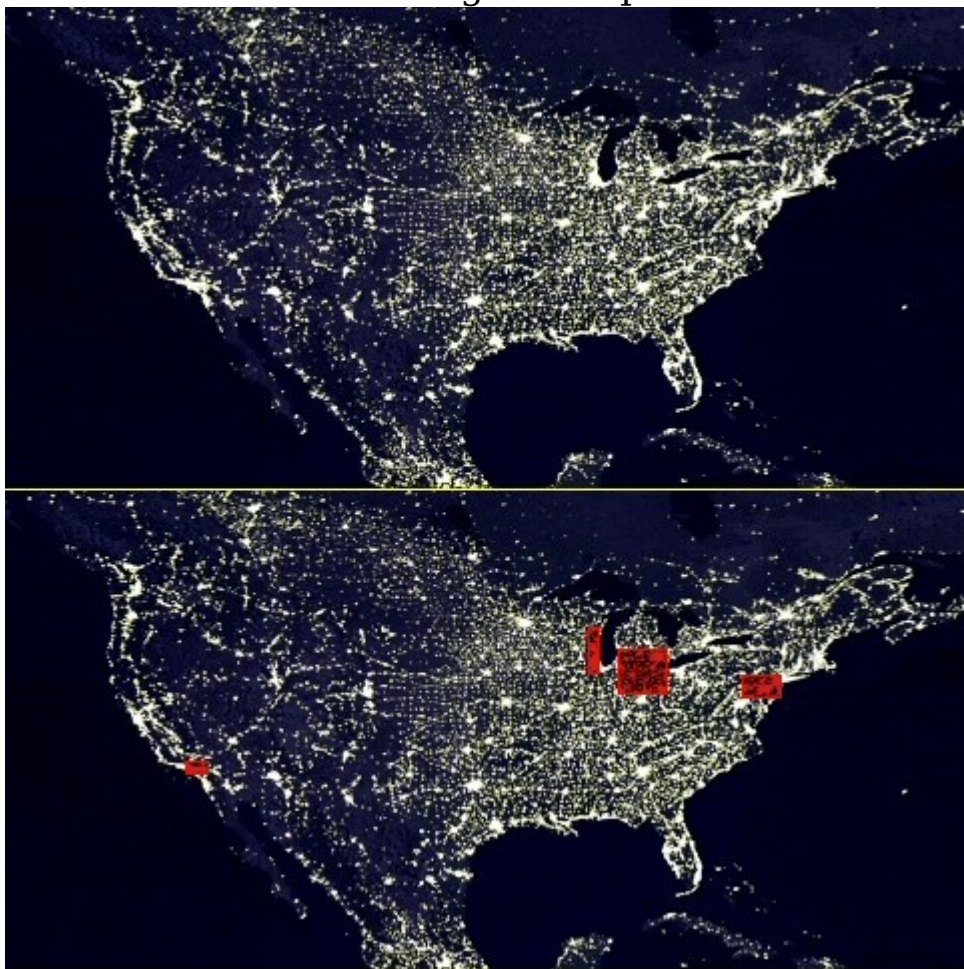
Steve Violich: Mixed parenthesis strings  
 Multiset permutations

Maximum subarray problem,  
researcher Sung Eun Bae, Ph.D candidate  
Mohammad Basher, Masters

To identify consecutive array portions with maximum sum  
in one-dimensional or two-dimensional arrays

One dimension: application for bio-informatics

Two dimension: promising customer range in sales database  
brightest spots in graphical images  
Mesh algorithm patented



**Data structures** 3-4 heap, extension of 2-3 heap  
Tobias Bethlehem, Masters

**Programming language and axiomatic semantics**  
Ryan Mallon, Masters, history variables